April 14, 2017

ERP Compliant Coke
3500 35th Avenue North
Birmingham, Alabama 35207

Attention: Mr. Wesley Hardegree

Re: **Response to EPA Comments on Corrective Measures Studies Dated 3/3/2017**
1. **SWMU Management Area (SMA 5) – Former Pig Iron Foundry**
2. **SMA 4 – Former Chemical Plant**

Administrative Order on Consent - Docket # RCRA 04-2012-4255
ERP Compliant Coke
3500 35th Avenue North
Birmingham, Jefferson County, Alabama
USEPA ID No. ALD 000 828 848
Terracon Project No. E1137227

Dear Mr. Hardegree:

On behalf of ERP Compliant Coke, LLC (ERP Coke), Terracon Consultants, Inc. (Terracon) is pleased to submit the enclosed revisions to the *Corrective Measures Study SMA 4 – Former Chemical Plant (Revision 1.1)* for the above-referenced site. These revisions have been prepared in response to Final Comments dated 3/3/17 for the Corrective Measures Study for SMA 5 Former Pig Iron Foundry and SMA 4 – Former Chemical Plant from the United States Environmental Protection Agency (USEPA) Region 4. The individual comments and responses are provided below.

Section 3.0 – Baseline Risk Assessment

USEPA Comment No. 1

Preliminary Cleanup Standards, SMA 4: EPA's review of the Preliminary Cleanup Standards (PCSs) found the following:

a. PCSs for SMA-4 groundwater (Table 3-24). Based on the listed exposure point concentrations and the site risks shown, EPA's risk assessor could verify some of the listed PCS values (e.g., Benzene, vinyl chloride), but other PSC values in this table could not be reproduced (e.g., Benzo(a)pyrene, Benzo(b)fluoranthene, Naphthalene, Toluene). Some of the values listed may be an issue of units (i.e., value shown would appear to be correct if the units were mg/L, but are not correct for ug/L)?

b. It is recommended that the preparer of the report recheck ALL values in this table. Also it would be helpful to add a column to list available health-based Maximum Contaminant Levels (MCLs) (Primary MCLs) since I assume MCLs would be selected as cleanup levels.

ERP Coke Response No. 1

Table 3-24 has been revised to include MCL and the values were checked for correctness based on concentrations presented as ug/L.

Section 4.0 Identification and Development of Preliminary Cleanup Standards and General Response Actions

USEPA Comment No. 2

Section 4.2.1 (Surface Soil), SMA 4: In discussing surface soil requiring remediation, the CMS Report includes the following statement: "The surface soil COCs above the PCS are presented in Table A-1 and on Figure 4-1. However, since the cumulative ELCR was below 10-4 and the HI was less than 1.0, surface soil contamination is not deemed to be a principle threat in need of active remediation." Basically, the report is concluding that although remediation is needed based on a comparison of the cumulative site risk to the EPA trigger levels, surface soil remediation is not needed (i.e., a risk management decision). As discussed in the March 1st meeting, there may be a few more reasons that could be added to support a no action decision (e. g., recent updates to PAH toxicity).

ERP Coke Response No. 2

Section 4.2.1 has been revised to discuss additional reasons supporting no active surface soil remediation.

USEPA Comment No. 3

Section 4.2.2 (Subsurface Soil), SMA 4: In discussing subsurface soil requiring remediation, the CMS Report includes the following statement: “The subsurface soil COCs above the PCS are presented in Table A-2 and on Figure 4-2. The cumulative ELCR was below 10-4 and the cumulative HI was less than 1.0." Is subsurface soil remediation needed to address human health risk? Similar to the discussion of surface soil in Section 4.2.1, should Section 4.2.2. of the report present a conclusion as to whether subsurface soil remediation is needed? If yes, please add reasons to support a risk management decision to take no action.

ERP Coke Response No. 3

Section 4.2.2 has been revised to discuss additional reasons supporting no active subsurface soil remediation.

USEPA Comment No. 4

Sections 6.2.4.2, 6.2.5.3 (In-Situ Subsurface Soil Treatment), SMA 4: There seems to be a slight conflict (potential confusing point) in use of "subsurface soil" in these two alternatives. In Sections 4.2.1 and 4.2.2, the apparent intent of the CMS Report is to conclude that active soil remediation is not needed to address human health risk from surface and subsurface soil above the Preliminary Cleanup Standards. However, Sections 6.2.4.2 and 6.2.5.3 both discuss addressing subsurface soil. Is the subsurface soil discussed in Sections 6.2.4.2 and 6.2.5.3 really subsurface source material contributing to the groundwater contamination and not subsurface soil being treated to address human health exposure risk noted in Section 4.2.2? Could some other term/phrase be used to distinguish between 1) subsurface soil and 2) subsurface source material that is contributing to groundwater contamination? Maybe use of the term "source area" (defined to include both subsurface source material in the soil and its associated and concentrated nearby groundwater contamination) could help with distinguishing between those subsurface areas in need of treatment and more dispersed subsurface soil contamination.

ERP Coke Response No. 4

These Sections have been revised to address In-Situ Soil Source Area Treatment instead of In-Situ Subsurface Soil Treatment. The entire sections have been revised to make it clear that we are referring to in-situ treatment of the soil source areas and associated groundwater in those areas in order to prevent leaching of chemicals into the groundwater and not for cleanup of the subsurface soil in general since the subsurface soil itself did not pose a risk to human health based on the HHRA.

USEPA Comment No. 5

Sections 6.2.4.2 and 6.2.5.2: Section 6.2.4.2 discusses in-situ treatment of subsurface soil and groundwater while Section 6.2.5.2 discusses in-situ treatment of only subsurface soil. Should Section 6.2.5.2 be equivalent to Section 6.2.4.2 (i.e., in-situ treatment for both soil and groundwater)? Could use of "in-situ source area treatment" (which includes both soil and highly concentrated nearby groundwater) be used to help with distinguishing subsurface areas in need of treatment from more dispersed subsurface soil contamination?

ERP Coke Response No. 5

These Sections have also been revised to address In-Situ Soil Source Area Treatment instead of In-Situ Subsurface Soil Treatment. The entire sections have been revised to make it clear that we are referring to in-situ treatment of the soil source areas and associated groundwater in those areas in order to prevent leaching of chemicals into the groundwater and not for cleanup of the subsurface soil in general since the subsurface soil itself did not pose a risk to human health based on the HHRA.

Section 7.0 — Evaluation of the Corrective Action Alternatives
Section 8.0 — Justification and Recommendation of the Corrective Measures

USEPA Comment No. 6

Recommended Remedy, SMA 4: The last two evaluated remedies are of most interest to EPA. CAA4 is titled Land Use Controls, In-situ subsurface Soil Treatment, In-situ Groundwater Treatment and Groundwater Monitoring. The recommended remedy is CAAS, which is tilted Land Use Controls + In-Situ Subsurface Soil Treatment + Groundwater Removal and Treatment + Groundwater Monitoring. EPA is interested in understanding how the in-situ subsurface soil treatment is going to occur separate from and without also including in-situ groundwater treatment? As previously expressed (e.g., Global Comments 23 and 32 from EPA Comment Letter dated 8/26/16), EPA is concerned that the groundwater removal alone will not be sufficient cleanup the groundwater due to subsurface sources remaining. Does the recommended remedy's (CAA 5) reference to In-Situ Subsurface Soil Treatment also encompass In-Situ Groundwater Treatment?

ERP Coke Response No. 6

This section has been updated to include groundwater in-situ treatment in the areas of soil source area treatment since an ancillary benefit of treating source soil will be some treatment of the collocated groundwater.

USEPA Comment No. 7

Recommended Remedy, SMA 4: The type of in-situ source area (soil and nearby groundwater) treatment, either chemical or biological, will be determined through later field work. Currently, the CMS Report provides two broad categories of in-situ treatment - chemical, biological. The report should include a little more detail as to the types of chemical or biological treatment that will be investigated during the Corrective Measures Implementation (CMI) phase.

ERP Coke Response No. 7

A list of potential chemical and biological treatments has been added to Section 8.1.

USEPA Comment No. 8

Post-Remedy Selection (i.e., Remedy Implementation), SMA 4 and 5: FYI: After EPA issues its Response to Comments (RTC) and Final Decision document selecting the remedy, a Corrective Measures Implementation (CMI) plan will be needed. The CMI plan will need to include the following, at a minimum:

a. A description of the conceptual design, technical features (e.g., plans and specifications, including any treatability studies) and a construction plan for the selected remedy(ies) to achieve media cleanup standards protective of human health and the environment, controlling the source(s) of the release, and complying with standards for the management of wastes and any remedial residues;
b. A proposed schedule that takes into account all phases of the CMI. The schedule should also include the submittal of documents to support the CMI (e.g., operation and maintenance plan, construction completion report); and
c. Requirements for removal and decontamination of units, equipment, devices, and structures that will be used to implement the remedy(ies).

ERP Coke Response No. 8

Section 8.2 has been added to incorporate the post-Remedy Selection process.

CLOSING

If you should have any questions, please do not hesitate to contact us at (205) 942-1289.

Sincerely,

Terracon Consultants, Inc.

Terrell W. Rippstein, AL-PG#8
Principal Geologist

cc: Ms. Meredith Anderson; USEPA Region 4

Corrective Measure Study
SMA 4 – Former Chemical Plant
(Revision 1.1)

ERP Coke
3500 35th Avenue North
Birmingham, Alabama
US EPA ID No. ALD 000 828 848

April 14, 2017
Terracon Project No. E1137227

Prepared for:

ERP compliant COKE
Birmingham, Alabama

Prepared by:

Terracon Consultants, Inc.
Birmingham, Alabama

terracon.com

Terracon

Environmental ■ Facilities ■ Geotechnical ■ Materials

Terracon

April 14, 2017

ERP Compliant Coke
3500 35th Avenue North
Birmingham, Alabama 35207

Attention: Mr. Don Wiggins

Re: **Corrective Measures Study**
SMA 4 – Former Chemical Plant (Revision 1.1)
ERP Compliant Coke
3500 35th Avenue North
Birmingham, Alabama 35207
US EPA ID No. ALD 000 828 848
Terracon Project No. E1137227

Dear Mr. Wiggins:

Terracon Consultants, Inc. (Terracon) is pleased to submit this Corrective Measures Study (CMS) for activities in conjunction with the site referenced above.

Should you have any questions or require additional information, please do not hesitate to contact our office.

Sincerely,
Terracon Consultants, Inc.

Terrell W. Rippstein, AL-PG #8
Principal Geologist

Dallas Whitmill, AL-PE#83070
Senior Project Engineer

Corrective Measures Study
SMA 4 – Former Chemical Plant (Revision 1.1)
ERP Coke
3500 35th Avenue North
Birmingham, Alabama
US EPA ID No. ALD 000 828 848

Project No. E1137227
April 14, 2017

EXECUTIVE SUMMARY

Background

Under the September 24, 2012 Administrative Order on Consent (2012 AOC) between Walter Coke, Inc. and EPA, the Former Chemical Plant (FCP) is Solid Waste Management Unit (SWMU) Management Area (SMA) 4. This CMS is for SMA 4 and is submitted on behalf of ERP Compliant Coke, LLC (ERP Coke). (ERP Coke acquired certain assets of Walter Coke, Inc., including the facility at which SMA 4 is located, in a transaction in which ERP Coke agreed to implement the 2012 AOC.) SMA 4 contains twelve SWMUs and two Areas of Concern (AOCs):

- SWMU 26 – Main Process Building
- SWMU 27 – Floor Drain System
- SWMU 28 – Sulfonation Floor Drain
- SWMU 29 – Product Tank Containment Area
- SWMU 30 – Centrifuge Waste Water Tank
- SWMU 31 – Monohydrate Floor Drain and Sump
- SWMU 32 – Drum Storage Area
- SWMU 33 – Plant Drum Storage Area
- SWMU 34 – Wastewater Neutralization System
- SWMU 35 – Mineral Wool Piles
- SWMU 36 – Used Oil Tank
- SWMU 42 – Former Above Ground Storage Tanks (ASTs)
- AOC B – Drainage Ditch next to Shuttlesworth Drive and 35th Avenue
- AOC D – Former Chemical Plant (FCP) Groundwater Plume

The operation of the facility now owned by ERP Coke can be traced back to 1881 when Sloss-Sheffield Steel and Iron Company first began producing pig iron in Birmingham, Alabama. In 1920, Sloss-Sheffield Steel and Iron Company built two modern coke oven batteries, at the time in North Birmingham, to serve its own needs as well as those of other customers. As Birmingham's steel industry grew, so did the need for furnace coke, which prompted the construction of three more batteries at the site during the 1950s.

The original coke manufacturing facility began operation in 1920 as Sloss Sheffield Steel and Iron Company. Beginning in 1952, the company experienced a series of corporate reorganizations and several name changes. Then, in February 2016, the facility was purchased by ERP Coke. The following operations have occurred at the facility:

- The biological treatment facility (BTF), designed to treat wastewater generated at the facility, was constructed in 1973-74, first received wastewater in 1975 and is still in operation today. SMA 1 includes the BTF Process Area.

- Land Disposal Areas (LDAs) have been used at various times over the life of the facility. Biological sludge, blast furnace sludge, and construction and demolition debris have been placed in the land disposal areas. SMA-2 includes the LDAs.

- Coke manufacturing has occurred since 1920 and 120 coke ovens continue to operate. SMA-3 includes the Coke Manufacturing Plant.

- Chemical manufacturing began at the facility in 1948 and all chemical manufacturing operations ceased in 2002. In addition, a mineral wool plant which manufactured mineral fiber used in the production of ceiling tile and insulating products was built in late 1947 and was decommissioned in 2010. SMA-4 includes the FCP and the mineral wool piles.

- An iron blast furnace that produced pig iron from iron ore began operation in 1958; blast furnace operations ceased in 1981, and the blast furnace was decommissioned in 1984. SMA-5 includes the Former Pig Iron Foundry.

A RCRA Section 3008(h) Administrative Order on Consent (Order) with the effective date of September 24, 2012, was signed by Walter Coke (and ERP Coke has agreed to implement the 2012 AOC as a condition of its purchase of certain Walter Coke assets) and the EPA. In the 2012 AOC, there are 45 SWMUs and 6 AOCs, all consolidated into 5 SMAs, listed at the facility.

Key Conclusions from this CMS

1. The CMS shows that no corrective action is needed in SMA 4 to address off-site residents. The CMS shows that any risks are so low as to be negligible because:
    a) The calculated risk associated with the Mineral Wool Piles is acceptable according to EPA criteria and essentially approaches zero. And even this calculated risk likely overstates actual risk because the calculations used standard assumptions for residential exposure that likely substantially overstate exposure compared to reality because (i) the Mineral Wool Pile is not residential soil and emissions, if any, from the Mineral Wool Piles would experience

dispersion before reaching any residence and (ii) the Mineral Wool Piles, unlike soil, form a crust and have a vegetative cover that significantly lowers the potential for emissions.

b) The results of the completed Vapor Intrusion Study for the area just past the facility boundary to the east concluded that off-site vapor intrusion is likely not occurring and, as EPA has agreed, does not warrant further action.

c) There are no other media in SMA 4 that off-site residents could plausibly be exposed to.

2. The risk to industrial workers from the Mineral Wool Piles is also acceptable according to EPA criteria and does not warrant any action on the Piles. That no action is needed to address the Mineral Wool Piles is consistent with past correspondence with EPA confirming the product's benign nature.

3. Any risks to human health or the environment from SMA 4 surface and subsurface soils do not warrant corrective action as long as the site is nonresidential because risks from these soils fall within EPA's acceptable range for industrial and construction workers. Recommended land-use controls will ensure that the site remains nonresidential.

4. In-situ treatment is recommended for certain soil source areas in order to address the potential for leaching from those soils into groundwater. The goal of treatment will be to lower soil concentrations of the relevant contaminants to below the leachability screening levels on a domain averaging basis. In addition, groundwater in the area of the soil source areas will receive some treatment as an ancillary benefit of this soil treatment. This will in turn help to reduce contaminant mass within the groundwater plume. This treatment will help ensure the effectiveness of the recommended groundwater remedy.

5. A pump and treat remedy is recommended for groundwater in SMA 4 in order to attempt to restore groundwater to the extent feasible and to address the calculated assumed risk to construction and industrial workers. Although addressing these calculated risks to construction and industrial workers is one of the goals of the recommended groundwater corrective action, the CMS likely overstates the risks to these workers for at least the following reasons:

a) As to construction workers, no construction projects are planned in SMA 4, and if any occur before corrective action is completed, the recommended land use control plan would mitigate risks with measures like PPE requirements and/or excavation permits.

b) As to current industrial workers, the only potentially complete groundwater exposure pathway is vapor intrusion. Currently, the groundwater removal interim measure is remediating groundwater and thereby reducing risk from vapor intrusion, and it will continue to do so as the recommended corrective action. In addition, the location, nature, and use of existing structures nearest to the SMA 4

groundwater plume are such that vapor intrusion from SMA 4 may not be occurring in those structures or that any vapor intrusion or vapor intrusion exposure occurring in them may be considerably less extensive than EPA's standard assumptions that are used in this CMS.

c) For future industrial workers, the vapor intrusion considerations applicable to current industrial workers apply. Also, though, these workers were assumed to use groundwater for potable purposes like showering, but such use of groundwater does not currently occur, is unexpected and extremely unlikely, and would be contrary to generally applicable local law that prohibits the use of groundwater for potable purposes. Thus, the calculated risks associated with a future industrial worker's use of groundwater for potable purposes are purely hypothetical. Even so, the recommended corrective action will reduce these risks.

Overview of CMS Analyses

A human health risk assessment (HHRA) is presented in this CMS. The HHRA was prepared to determine if constituents detected exceed carcinogenic risks of 1E-06 and/or noncarcinogenic hazard quotients in excess of 0.1 based on certain conservative exposure assumptions. Site media included in the risk assessments included soil, groundwater, and the Mineral Wool Piles.

In addition, cleanup goals were calculated for constituents that exceeded the carcinogenic and noncarcinogenic risk thresholds for receptors for which the site-wide calculated or assumed ELCR exceeded EPA's acceptable range.

As discussed in the OSWER Directive 9355.0-30 dated April 22, 1991, acceptable risk levels, where the cumulative carcinogenic risks to an individual based on reasonable exposure, can range from 10E-4 to 10E-6 as long as the cumulative excess lifetime carcinogen site risk is less than 10E-4 and the noncancer hazard index (HI) is less than 1.0. For each receptor with a site-side cumulative ELCR greater than 10E-4, Preliminary Cleanup Standards (PCSs) were calculated for each such receptor for each media type for constituents of concern (COCs) that exceeded a ELCR of 10E-6 or a HI of 0.1. PCS for each COC were calculated for an ELCR of 10E-4, 10E-5, and 10E-6 and a HI of 3, 1, and 0.1. In order to meet the goal of the cumulative ECLR of less than 10E-4 and a HI of 1.0 across all media, the analytical samples from each sample media were compared to the calculated PCS with the ELCR of 10E-5 or a HI of 0.1. The value for the most conservative receptor (lowest value) for the 10E-5 target risk level or HI of 0.1 was selected as the PCS for human health exposure. Groundwater COCs were also compared to the United States Environmental Protection Agency (USEPA) maximum contaminant levels (MCLs).

As part of the CMS, corrective action alternatives were identified, screened, and evaluated in terms of effectiveness, implementability, and cost so the most protective, efficient, and

economical remedial alternative could be identified and selected to remediate media that exceeded the calculated PCSs. The six alternatives evaluated are summarized below:

Alternative 1 No Action

The *No Action* alternative assumes that no further remedial action will occur at the site and has been included to establish a baseline for alternative comparison.

Alternative 2 Physical, Legal, and Administrative Barriers (Land Use Controls)

The *Physical Barrier, Legal Barrier, and Administrative Barrier* (Institutional Control) alternatives consist of administrative and physical mechanisms to place restrictions on the use of and limit access to the site and/or specific SWMUs/AOCs to prevent exposure to site contaminants.

Alternative 3 Land Use Controls + Groundwater Monitoring

The *Land Use Controls and Groundwater Monitoring* alternative consists of a combination of technologies including administrative land use controls and groundwater monitoring. This alternative would meet the corrective measure objectives by monitoring the contaminated site groundwater to ensure the groundwater constituent concentrations are stable and implementing a Land Use Control Plan (LUCP) to protect future receptors in the unlikely event the land use changes.

Alternative 4 Land Use Controls + In-Situ Soil Source Area Treatment + In-Situ Groundwater Treatment + Groundwater Monitoring

The *Land Use Controls, In-Situ Soil Source Area Treatment, In-Situ Groundwater Treatment, and Groundwater Monitoring* alternative consists of a combination of technologies including administrative land use controls, in-situ injection to treat subsurface soil and groundwater, and groundwater monitoring. This alternative would meet the corrective measure objectives by reducing and/or eliminating exposure to the affected site media (see Section 4.3) through injection of bacteria or chemicals to remove contaminants and the development and implementation of a LUCP to protect future receptors in the unlikely event the land use changes. In addition, long term groundwater monitoring would confirm that the treatment is effective.

Alternative 5 Land Use Controls + In-Situ Soil Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring

The *Land Use Controls, In-Situ Soil Source Area Treatment, Groundwater Removal and Treatment, and Groundwater Monitoring* alternative would meet the corrective measure objectives by reducing and/or eliminating exposure to the affected site media (see Section 3.3) through in-situ treatment of soil source areas (with associated ancillary treatment of groundwater) and through removal and

treatment of contaminated groundwater. In addition, a LUCP will be implemented to protect future receptors in the unlikely event the land use changes. In addition, groundwater monitoring would confirm that the chosen treatment alternative is effective.

Based on the conclusions of the detailed analysis that was performed individually and collectively with respect to the five alternatives, one alternative was recommended to address potential contamination of the impacted media. The selected alternative is listed below:

Alternative 5 Land Use Controls + In-Situ Soil Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring

The *Land Use Controls, In-Situ Soil Source Area Treatment, Groundwater Removal and Treatment, and Groundwater Monitoring* alternative would be the most efficient and economical method to meet the Corrective Action Objectives (CAOs) for SMA 4 and provide long-term protection of human health and the environment.

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ADAF	Age-dependent adjustment factor
ADD	Average daily dose
ADEM	Alabama Department of Environmental Management
AF	Adherence factor
ABS_d	Absorption fraction, dermal
A_R	Surface area of contaminated road segment
AOC	Area of Concern
ANPR	Advanced Notice of Proposed Rulemaking
AT	Averaging time
AUF	Area Use Factors
BCFs	Bioconcentration Factors
BTF	Biological Treatment Facility
BW	Body weight
CA	Chemical concentration in air
CAA	Corrective Action Alternative
CAO	Corrective Action Objective
CAP	Corrective Action Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
CF	Conversion factor
COC	Chemical of concern
COPC	Chemical of potential concern
cm/sec	centimeter per second
CMS	Corrective Measure Study
COC	Contaminant of Concern
COPC	Constituent of Potential Concern
COPEC	Constituent of Potential Ecological Concern
CR	Cancer Risk
Cshw	Chemical concentration remaining in shower water
CSM	Conceptual site model
CW	Chemical concentration in groundwater
DA_{event}	Absorbed dose per event
DAD	Dermal absorbed dose
DC	Dietary composition
DI	Daily Intake
DOT	Department of Transportation
DWEL	Drinking Water Equivalency Level
EC	Exposure concentration
Eco SSLs	Ecological soil screening levels
ERAGS	Ecological Risk Assessment Guidance for Superfund

ED	Exposure Duration
EF	Exposure Frequency
EI	Environmental Indicators
ELCR	Excess lifetime cancer risk
ERA	Ecological risk assessment
ERAGS	*Ecological Risk Assessment Guidance for Superfund*
ET	Exposure Time
EPC	Exposure point concentration
ERA	Ecological risk assessment
EV	Event frequency
FA	Fraction of chemical absorbed
FCP	Former Chemical Plant
FMC	Five Mile Creek
F_D	Dispersion correction factor
F_W	Flow rate, water
FI	Fraction Ingested
FWI	Facility Wide Investigation
GPRA	Government Performance Results Act
HDPE	High-Density Polyethylene
HHRA	Human Health Risk Assessment
HHRE	Human Health Risk Evaluation
HI	Hazard Index
IM	Interim Measures
IR	Ingestion rate
IRIS	Integrated Risk Information System
IUR	Inhalation unit risk
Kp	Dermal permeability coefficient in water
LDA	Land Disposal Area
LDR	Land Disposal Restriction
LOAEL	Lowest observed adverse effects level
LUCP	Land Use Control Plan
MCL	Maximum Contaminant Level
NCEA	National Center for Environmental Exposure
NCP	National Contingency Plan
NIR	Normalized ingestion rate
NOAEL	No observed adverse effects level
NRWQC	National Recommended Water Quality Criteria
Order	Administrative Order on Consent
ORD	Office of Research and Development
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PCS	Preliminary Cleanup Standards

PEF	Particle emission factor
PIF	Pig Iron Foundry
PPRTV	Provisional Peer Reviewed Toxicity Value
PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
PVC	Poly Vinyl Chloride
RAGS	Risk Assessment Guidance for Superfund
RBP	Rapid Bioassessment Protocol
RCRA	Resource Conservation and Recovery Act
RCRIS	RCRA Information System
RfC	Reference concentration
RfD	Reference Dose
PCS	Preliminary Cleanup Standards
RFI	RCRA Facility Investigation
RSL	Regional Screening Levels
SA	Skin surface area
SCS	Soil Conservation Service
SF	Slope Factor
SLERA	Screening Level Ecological Risk Assessment
SMA	SWMU Management Area
SPUF	Soil-to-plant uptake factor
SSL	Soil screening level
SVOC	Semi-volatile Organic Compound
SWMU	Solid Waste Management Unit
T	Total time
TAL	Target Analyte List
TBD	To Be Determined
TCL	Target Constituent List
TCLP	Toxicity Characteristic Leaching Procedure
TRVs	Toxicity Reference Values
TSD	Treatment, Storage, And Disposal
UCL	Upper Confidence Limit
UF	Uptake factor
USEPA	United States Environmental Protection Agency
Va	Volume, bathroom
VDEQ	Virginia State Department of Environmental Quality
VF	Volatility factor
VI	Vapor Intrusion Study
VISL	Vapor intrusion screening calculator
VOC	Volatile Organic Compounds

Corrective Measures Study
SMA 4 – Former Chemical Plant (Revision 1.1)
ERP Coke
3500 35th Avenue North
Birmingham, Alabama

Project No. E1137227
April 14, 2017

1.0 INTRODUCTION

The ERP Compliant Coke, LLC (ERP Coke) facility is located at 3500 35th Avenue North in Birmingham, Jefferson County, Alabama (Figure 1-1). This Corrective Measures Study (CMS) for SMA 4 has been prepared in accordance with paragraph 29 of the Order on Consent with effective date of September 24, 2012. A map of the current facility including the 45 Solid Waste Management Units (SWMUs) and six Areas of Concern (AOCs) consolidated into five SWMU Management Areas (SMAs) is included as Figure 1-2.

The roots of the facility can be traced back to 1881 when Sloss-Sheffield Steel and Iron Company first began producing pig iron in Birmingham, Alabama. In 1920, where ERP Coke sits today, Sloss-Sheffield Steel and Iron Company built two modern coke oven batteries to serve its own needs as well as those of other customers. As Birmingham's steel industry grew, so did the need for furnace coke, which prompted the construction of three more batteries at the site during the 1950s.

As American industry evolved in the ensuing years, so did the operation of the facility. Today, ERP Coke is a highly efficient, technologically advanced operation serving a variety of customers in the furnace and foundry markets.

The operation now consists of three batteries with a total of 120 coke ovens which produce approximately 460,000 tons of coke each year. A highly experienced operating staff provides assurance of adherence to strict operating, environmental, and safety standards.

The original coke manufacturing facility began operation in 1920 as Sloss Sheffield Steel and Iron Company. Beginning in 1952, the company experienced a series of corporate reorganizations and several name changes culminating in a name change to Walter Coke, Inc. in June 2009, and then the purchase of the coke plant assets by ERP Compliant, Coke, LLC occurred in February 2016. The following operations have occurred at the facility:

- The biological treatment facility (BTF), designed to treat wastewater generated at the facility, was constructed in 1973-74, first received wastewater in 1975 and is still in operation today. SMA 1 includes the BTF Process Area.

- Land Disposal Areas (LDAs) have been used at various times over the life of the facility. Biological sludge, blast furnace sludge, and construction and demolition debris have been placed in the land disposal areas. SMA 2 includes the LDA.

- Coke manufacturing has occurred since 1920, and 120 coke ovens continue to operate. SMA 3 includes the Coke Manufacturing Plant.

- Chemical manufacturing began at the facility in 1948, and all chemical manufacturing operations ceased in 2002. In addition, a mineral wool plant, which manufactured mineral fiber used in the production of ceiling tile and insulating products, was built in late 1947 and was decommissioned in 2010. SMA 4 includes the FCP and the mineral wool piles.

- An iron blast furnace that produced pig iron from iron ore began operation in 1958; blast furnace operations ceased in 1981, and the blast furnace was decommissioned in 1984. SMA 5 includes the Former Pig Iron Foundry (FPIF).

The land around the ERP Coke facility is zoned for industrial and residential use, and a significant number of other industrial facilities remain operational in the area. Before 1957, the area was primarily industrial, with a significant number of other facilities, including coke and cement manufacturing plants, pipe manufacturing plants, and limestone quarry operations. Residential neighborhoods were constructed on properties in the area of ERP Coke only after 1957 (USEPA, 1990). The most likely future land use for the ERP Coke facility is industrial.

1.1 1989 RCRA Order

The following provides a brief chronological overview of key points in the regulatory history associated with the 1989 RCRA Order:

- August 1989 - EPA completed the RCRA Facility Assessment (RFA).
- September 29, 1989 - Section 3008(h) Administrative Order 89-39-R was issued requiring performance of an RFI and a CMS.
- October 24, 1990 – After a challenge to the 1989 Administrative Order, a Modification to the Administrative Order and Settlement Agreement was entered and then governed work at the facility.
- 1990 to 1994: Planning for the RFI to characterize the nature, extent, and rate of contaminant migration from the identified SWMUs was submitted, and a draft RFI Work Plan was submitted to EPA for review and approval.
- The RFI Work Plan, which outlined an approach for investigating the 39 SWMUs, was approved by EPA in 1994.

- 1995 and 1996 – A Facility-Wide Investigation (FWI) was completed to develop a conceptual hydrogeologic and hydrologic model of the facility.
- 1996 to 1999 – Numerous RFI field investigations were conducted and reports submitted to EPA.
- 2000 to 2001 – Phase II field investigations were conducted.
- 2002 – Interim Remedial Measures (IM) Work Plan for the Chemical Plant was submitted to EPA.

In an effort to help EPA complete its environmental indicator (EI) determinations for the site and thereby help EPA meet its Government Performance Results Act (GPRA) goal to show that human exposures and groundwater releases were controlled by September 30, 2005, the following activities that are specific for EI determination were completed:

- February 2005 –Proposed EI Sampling Plan submitted.
  - March 2005 – EPA approved the EI Sampling Plan.
- July 2005 - Consolidated Overview of Environmental Data in Support of the EI Determination submitted.
  - September 30, 2005 – EPA issued the final EI evaluation of the facility's status in relation to RCRA Information System (RCRIS) CA Codes 725 and 750. The CA 725 decision was noted as "Yes"; the CA 750 decision was noted as "No".
  - March 16, 2012 - EPA issued another EI evaluation of the facility's status in relation to RCRA Information System (RCRIS) CA Codes 725 and 750. The CA 725 decision was noted as "No"; the CA 750 decision was noted as "No".

Following the completion of the EI activities, the next phase of RFI activities was the focus.

- 2006 – EPA issued technical comments on several RFI reports.
- 2007 – Phase III RFI Work Plan was prepared and approved by EPA.
- 2009 –Draft Phase III RFI Report submitted.
  - June 2009 –Addendum to the Phase III report submitted.

1.2 2012 RCRA Order

Pursuant to EPA's stated desire to update the 1989 Order, Walter Coke and EPA entered a RCRA Section 3008(h) Administrative Order on Consent (AOC) with the effective date of September 24, 2012. The 2012 AOC declared that all of the approved investigation tasks of the RCRA Facility Investigation (RFI) Work Plans required by the 1989 Order had been completed and that the 1989 Order was terminated and no longer in effect. Under the 2012 AOC, there are 5 SMAs consisting of 45 SWMUs and 6 AOCs at the facility (Figure 1-2). In February 2016, ERP Coke purchased certain assets of Walter Coke, Inc., including the coke plant, in a transaction in which ERP Coke agreed to implement the 2012 AOC.

As part of the Order, a CMS is being prepared for each of the 5 SMAs to evaluate the need, if any, for corrective measures. The scheduled completion date for each CMS is:

- CMS SMA 1 – Previously submitted to EPA on May 24, 2013 (Revision 1.0 submitted to EPA on January 24, 2014)
- CMS SMA 2 – Previously submitted to EPA on July 22, 2013
- CMS SMA 3 – Previously submitted to EPA on September 24, 2013
- CMS SMA 4 – Previously submitted to EPA on March 24, 2014 (Revision 1.0 is this submittal)
- CMS SMA 5 – September 24, 2014 (Revision 1.0 submitted September 30, 2015 and Revision 1.1 submitted May 20, 2016)

In addition to the CMS, Interim Measures (IMs) are being conducted in the area of SMA 4 to address groundwater impacts largely confined to the site. The IMs consists of hydraulic control and treatment of the groundwater in AOC D [Former Chemical Plant (FCP) Groundwater Plume], groundwater sampling and analysis.

1.3 Corrective Measures Study (CMS) Overview

The CMS is the portion of the RCRA corrective action process designed for the identification and evaluation of potential remedial alternatives for conditions that have been documented at a facility (USEPA, 1994). Once properly evaluated with respect to criteria such as overall protectiveness, effectiveness, and costs, risk managers should have sufficient information to select and initiate the implementation of remedies, if any.

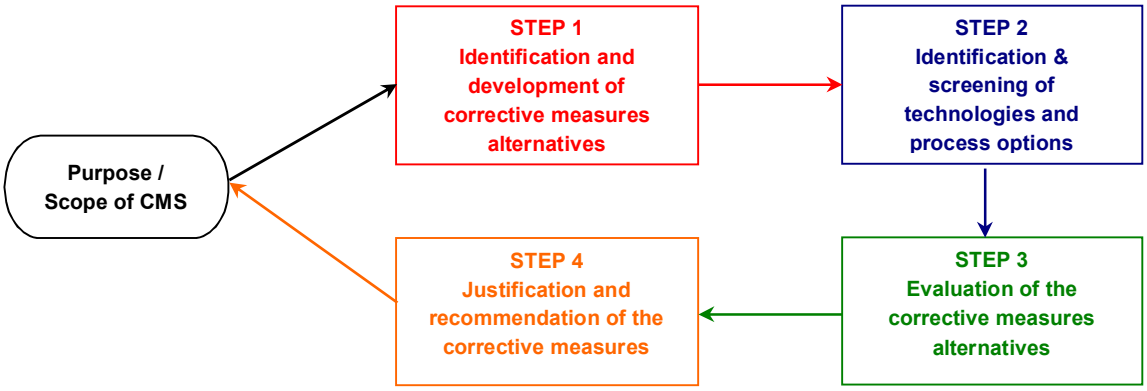
The purpose of this CMS Report is to summarize the evaluation, analysis, and selection of appropriate corrective action at SMA 4. SMA 4 consists of twelve SWMUs and two AOCs (Figure 1-3). They include:

- SWMU 26 – Main Process Building
- SWMU 27 – Floor Drain System
- SWMU 28 – Sulfonation Floor Drain
- SWMU 29 – Product Tank Containment Area
- SWMU 30 – Centrifuge Waste Water Tank
- SWMU 31 – Monohydrate Floor Drain and Sump
- SWMU 32 – Drum Storage Area
- SWMU 33 – Plant Drum Storage Area
- SWMU 34 – Wastewater Neutralization System
- SWMU 35 – Mineral Wool Piles
- SWMU 36 – Used Oil Tank
- SWMU 42 – Former Above Ground Storage Tanks (ASTs)
- AOC B – Drainage Ditch next to Shuttlesworth Drive and 35th Avenue

- AOC D – Former Chemical Plant (FCP) Groundwater Plume

This CMS has been prepared to identify remedial alternatives identified for SMA 4. As part of the CMS activities, a Risk Assessment Work Plan (Revision 1.1) was submitted to EPA on March 6, 2013. The Risk Assessment Work Plan was approved by EPA on March 15, 2013. In accordance with that Plan, the Risk Assessment prepared as part of this CMS, will consider risk in SMA 4 and clean up goals for various constituents present in SMA 4. The CMS will also identify and compare remedial alternatives for certain affected media present in SMA 4. The data set utilized to conduct the Risk Assessment was a comprehensive Microsoft Access database provided to Terracon by CH2MHILL. It is our understanding that this database was inclusive of the data collected at the site during all investigations previously conducted at the facility. The Risk Assessment being performed during the CMS process derives and calculates assumed potential risks to human health and the environment based on highly protective assumptions that are unlikely to occur in reality. Carcinogenic risks in excess of 1E-06 and/or noncarcinogenic hazard indexes in excess of 1.0, were used to delineate areas and volumes of affected media, and corrective action alternatives were developed and evaluated as possible site cleanup remedies. This CMS focuses primarily on addressing the potential risks posed to site receptors from exposure to contaminants at SMA 4.

Four fundamental phases or steps, as shown in the diagram below, are inherent to the development of any CMS. Once these steps are defined, a wide range of options exist for structuring and refining a CMS to meet the specific goals, objectives, and regulatory requirements associated with a given project site. Based on the RCRA Corrective Action Plan, OSWER Directive 9902.3-2A (May 1994), Chapter IV – Corrective Measures Study, this CMS Report was prepared according to the following steps:



1.4 Site Description

The ERP Coke facility is located at 3500 35th Avenue North in Birmingham, Jefferson County, Alabama, as shown on Figure 1-1. This active, coke production facility encompasses an area of

approximately 460 acres. SMA 4 is located on the southeastern end of the facility, as shown on Figure 1-2.

SMA 4 comprises the FCP. SWMU 26 – Main Process Building was the main process building of the FCP. SWMU 27 – Floor Drain System, SWMU 28 – Sulfonation Floor Drain, and SWMU 31 – Monohydrate Floor Drain and Sump are floor drains and sumps in the processing portion of the FCP. SWMU 29 Product Tank Containment Area, SWMU 30 – Centrifuge Waste Water Tank, and SWMU 42 – Former Aboveground Storage Tanks (ASTs) are process tanks that were located in the immediate vicinity of the FCP. SWMU 32 – Drum Storage Area and SWMU 33 – Plant Drum Storage Area was an area that was used to store drums of chemicals used in the processes conducted at the FCP and the Coke Plant. SWMU 34 – Wastewater Neutralization System was used to neutralize the pH prior to the waste water entering the biological treatment process. SWMU 35 – Mineral Wool Piles are piles of Mineral Wool that originated in the Mineral Wool Plant that was previously located on the site. The mineral wool was placed onto large piles, and is being marketed for beneficial re-use. SWMU 36 – Used Oil Tank is an area located north of the FCP building which formerly contained a used oil tank. AOC B – Drainage Ditch next to Shuttlesworth Drive and 35th Avenue is the drainage ditch that runs along the southern boundary of the ERP Coke Facility between the facility boundary and Shuttlesworth Drive/35th Avenue. AOC D – FCP Groundwater Plume is the groundwater plume of VOCs identified in the FCP area during previous investigations. Interim Measures (IM) has been implemented for AOC D. The IM includes hydraulic control and treatment of the groundwater plume. Additionally, a Vapor Intrusion Study in the offsite area immediately to the east of the FCP has been completed, and the results demonstrated and EPA agreed that no further action was needed.

The FCP primary product lines were foundry catalyst used in sand cast foundry molds to make iron pipe and other foundry Products. The foundry catalysts consisted of sulfonic acid products. These products were benzenesulfonic acid (BSA), toluenesulfonic acid (TSA), xylensulfonic acid (XSA), chlorobenzensulfonic acid (CLBSA), and phenolsufonic acid (PSA). The raw materials used in the production were benzene, toluene, xylenes, chlorobenzene and phenol. These raw materials were reacted with sulfuric acid in glass lined reactors to produce the end products. In addition, para-toluenesulfonic acid (PTSA) was imported and sold along with this product line. Some specialty chemicals were also produced in the old chemical plant. Listed below are the products and associated raw materials:

PRODUCT	RAW MATERIALS
Benzenesulfonyl Chloride	BSA and Chlorosulfonic acid
Cholestatrienol	Extracted from yeast culture using Ethyl alcohol and Ethyl acetate
Dow Corning Products for Green Tires	Sulfido-silanes
2,6-naphthalene dicarboxylate (NDC)	additive for plastic food containers, made from 2,6-naphthalene dicarboxylic acid (NDA) and methyl alcohol.

PROCESSING AIDS

Sodium Hydroxide, Hydrochloric Acid, Calcium Hydroxide, Magnesium Hydroxide, Hydrogen Peroxide

1.5 Environmental Setting

1.5.1 Surface Water Bodies

There are no surface water bodies located in the vicinity of SMA 4. AOC B – Drainage Ditch next to Shuttlesworth Drive/35th Avenue is located outside of the plant fence and is considered part of SMA 4. This ditch runs east-northeast along 35th Avenue from the southernmost end of the property to the corner of Shuttlesworth Drive. The ditch then runs northeast along Shuttlesworth Drive to the eastern edge of the property. The ditch is located inside the property boundary.

1.5.2 Bedrock Geology

The facility is underlain by sedimentary rocks that range in age from Cambrian to Pennsylvanian. The Opossum Valley Fault generally trends northeast to southwest, crossing through the ERP Coke property in the northern portion of the facility at SWMU 22. The majority of the ERP Coke property lies on the hanging wall fault block to the east of the Opossum Valley Fault. The foot wall of the fault lies to the west and underlies Sand Mountain. The majority of the ERP Coke property is underlain by the Conasauga Formation. The Red Mountain Formation, Fort Payne Formation, Tuscumbia Limestone, Hartselle Sandstone, Floyd Shale, and Pottsville Formation outcrop in the small area of the facility on the western side of the fault on the north side of the facility. A Geologic Map is included as Figure 1-4. Cross Sections provided in the CH2MHILL Phase III RFI are included as Figures 1-5 through 1-7.

The Conasauga Formation is Cambrian Age and typically is medium gray, thin- to medium-bedded limestone. Locally, bedding thickness is reported to range from a few inches to as much as 5 feet or more in the massive sections. Massive bedding sections are rare and bedding thicknesses less than 1 foot are common. Locally, the Conasauga Formation dips to the southeast

at 26 to 32 degrees, with a strike of approximately N45°E. An extensive network of faults and joints has developed in the Conasauga Limestone because of thrust faulting. The faults and joints typically trend northeast and northwest. The northeast trending joints (strike of N45°E) dip approximately 60°NW (approximately perpendicular to bedding), while the northwest trending joints strike N300W and have subvertical dips. The results of previous investigations indicate that the upper 2 feet of the Conasauga Formation underlying the ERP Coke facility are highly weathered. Below the weathered surface, the limestone is generally massive, with few fractures. The limestone is typically hard, with 1- to 2-foot-thick lenses of softer, darker gray shale and shaley limestone. Occasionally, fractures are present, ranging from a few inches to a few feet thick. Fracture zones typically contain limestone rubble that exhibits secondary healing by calcite crystals. Fracture zones typically are encountered in the upper 50 feet of the formation and are less frequent with increasing depth.

On the western side of the Opossum Valley Fault (in the SWMU 22 area), outcrops of the Hartselle Sandstone, Tuscumbia Limestone, Fort Payne Chert, Red Mountain Formation, and Pottsville Formation have been mapped. Brief descriptions of these units are provided below:

- Hartselle Sandstone – composed mainly of clean, well-sorted, light-colored, very fine- to medium-grained quartz sand;
- Tuscumbia Limestone – consists of thick-bedded, medium-dark to medium-gray, crystalline, oolitic, sublithographic, and bioclastic limestone with minor amounts of chert;
- Fort Payne Chert – consists of dark-gray sublithographic limestone and dense dark-gray chert;
- Red Mountain Formation – consists of dark-reddish-brown to olive-gray siltstone, sandstone, and shale with hematite beds;
- Pottsville Formation – characterized by alternating beds of sandstone and shale with numerous coal seams and associated underclays.

The topography of the bedrock underlying the ERP Coke facility generally slopes to the north toward Five Mile Creek (FMC). Top-of-bedrock elevations range from 583.1 feet above mean sea level (amsl) in the Coke Plant area to 498.6 feet amsl near FMC. Weathering of the Conasauga Formation has produced undulations in the surface of the bedrock. Several feet of relief have developed on the bedrock surface. This relief is as much as several tens of feet in some areas of the property; however, karst features are not evident at the ground surface. Where exposed, enlargement of bedding planes and fractures appears to have occurred through solution of the bedrock. Solutionally enlarged fractures and joints primarily are limited to the upper few feet of bedrock and have been observed up to 1 foot wide.

1.5.3 Soils

The majority of the overburden at the ERP Coke facility consists of residual soil from weathered Conasauga Formation (residuum). On and adjacent to Sand Mountain (immediately west and

north of SWMU #22), residual soils have formed on the Hartselle Sandstone and the Tuscumbia Limestone. Near the Coke Plant and the FCP, industrial fill material is present at thicknesses ranging from 0.5 to 6 feet. Similar fill material is present in the BTF area. The overburden ranges in thickness from 2 to more than 20 feet. Native soil over limestone consists of cohesive, medium-stiff to stiff inorganic clays of low to medium plasticity and high plasticity. General engineering properties, as indicated by analytical and visual observations of site soil properties, include high shrink-swell potential, low permeability, and low-strength capabilities.

Near the base of the residuum at the bedrock interface, a zone of more permeable soils has developed, with chert and highly weathered limestone gravels consolidated from the weathering of the underlying bedrock. This area typically is referred to as the rubble zone. Where observed, the rubble zone appears to range up to 2 feet thick. The rubble zone does not appear to be laterally continuous throughout the facility, but may be a significant water bearing zone locally.

1.5.4 Hydrogeology

The conceptual hydrogeologic flow model for the site is composed of residuum groundwater, shallow bedrock groundwater, and deep bedrock groundwater. Groundwater occurs within the residuum where the water table is higher than the bedrock surface. Groundwater flow through this material occurs in interstitial pore spaces between the clay particles at a low rate due to the relatively low permeability. Flow rates may be higher where a concentration of chert gravels at the bedrock surface has occurred. Within the shallow and deep bedrock aquifers, groundwater migrates along fractures and bedding planes both horizontally and vertically. Within the shallow bedrock aquifer, groundwater flow is primarily horizontal due to the interconnectivity of the fractures. Groundwater within the shallow bedrock discharges to surface water bodies such as the Lafarge Quarry, surface drainage ditches, and FMC. Deep bedrock groundwater is anticipated to migrate toward discharge points such as the Lafarge Quarry.

Based on information provided in the Phase III RFI prepared by CH2MHILL, the groundwater monitoring well network at the Coke facility consists of 109 monitoring wells and piezometers. Monitoring wells and piezometers are constructed of 2-inch diameter, Schedule 40 polyvinyl chloride (PVC) casing and screens with a sand pack. Screens are typically 10 feet long with a 0.010-inch slot size. The sand pack typically extends a minimum of 2 feet above the top of the screen, above which a 2-foot bentonite well seal is installed. Neat cement grout, which typically is installed following hydration of the bentonite seal, extends upward to the ground surface. A surface isolation casing, usually 10-inch-diameter steel, typically is installed from the top of bedrock to the ground surface for bedrock monitoring wells at locations where residuum groundwater is encountered.

Monitoring wells can be grouped into four classifications based on the various units they monitor, as described in the following text:

- Residuum monitoring wells are those wells with screens that are completed within the unconsolidated residuum above bedrock or those monitoring wells with screens and sand filter packs that extend above the top of the bedrock (mixed monitoring). Eleven wells have been classified as residuum (or mixed) monitoring wells. Most of these wells are located in the BTF area, primarily surrounding SWMU 13.

- Shallow bedrock monitoring wells have screens completed entirely within the Conasauga Formation, with 10-foot screens generally between 0 and 40 feet below the top of the bedrock surface. These wells are situated in the fractured and weathered upper portions of the Conasauga Formation. There are 78 shallow bedrock monitoring wells.

- Deep bedrock monitoring wells have 10-foot screens completed between 40 and 300 feet below the top of the bedrock surface. These wells are situated in the less fractured and weathered lower portions of the Conasauga Formation, where groundwater flow is significantly slower than that observed in the shallow bedrock aquifer. There are 16 deep bedrock monitoring wells.

- Four monitoring wells have been completed in formations other than the Conasauga Limestone. These non-Conasauga monitoring wells have been installed at SWMU 23 in SMA 4, on the western side of the Opossum Valley Fault. They are not completed in the Conasauga Formation and their groundwater elevations are not included in the potentiometric surface maps developed for either the shallow or deep Conasauga Limestone flow zones in the Phase III RFI. These wells have been constructed with 10-foot screens, with total depths ranging from 63 feet to 118.5 feet below ground surface (bgs).

Three potential water-bearing zones are composed of 1) residuum soils and the upper weathered bedrock surface; 2) shallow bedrock (20 to 140 feet bgs); and 3) deep bedrock (140 feet bgs). Water enters the groundwater system in the valley via infiltration of rainfall through the residual soils and lateral migration of groundwater through the residuum and shallow bedrock aquifer. Recharge moves vertically downward until it encounters the rubble zone, where lateral groundwater flow across the bedrock surface may occur. Because of the discontinuous occurrence of groundwater in the residuum (based on observations during the site wide drilling efforts) and the relative lack of site wide residuum monitoring wells, a potentiometric surface map for residuum groundwater has not been developed.

Groundwater flows from the residuum into the shallow bedrock aquifer through fractures and joints in the Conasauga Formation. Within this formation, groundwater flow is controlled by the occurrence and relationships among fractures, joints, and bedding planes of the limestone and shale. These features are interconnected and comprise the dominant feature of the groundwater flow systems, providing flow paths for groundwater migration. Significant water-bearing zones in the Conasauga Formation vary laterally and with depth. The upper weathered bedrock surface,

fractures, and soft, shaley zones in the upper 20 feet to 140 feet appear to be hydraulically connected, based on historical water level data.

Although recovery rates are slow for wells completed in the deep Conasauga Formation, water level measurements indicate that the deep zone generally is in hydraulic connection with the more permeable shallow zones of the Conasauga Formation.

Potentiometric surface maps of the shallow and deep bedrock flow zones were developed for the facility during the Phase III RFI using water level measurements collected site wide on April 28 and 29, 2008 by CH2MHILL (Figures 1-8 and 1-9). Groundwater gradients depicted in the shallow bedrock potentiometric surface map, Figure 1-8, indicate that shallow bedrock groundwater generally flows from southwest to northeast toward FMC with local influence from Lafarge Quarry operations. The Lafarge Quarry is anticipated to serve as a discharge point for shallow bedrock groundwater.

Locally, a hydraulic ridge has developed in the shallow bedrock potentiometric surface, trending generally southeast to northwest and extending from P-19S beneath the Coke Plant toward the former Chemical Plant and MW-55 (a local groundwater high). Near the former Plant, groundwater flows radially away from MW-55. Groundwater appears to flow from the former Chemical Plant offsite to the east. Along the southern boundary of the ERP Coke facility, shallow bedrock groundwater appears to flow to the southeast. Groundwater elevations in the residuum in the BTF area are as much as 10 feet higher than those recorded in the shallow bedrock aquifer, indicating recharge of the shallow bedrock aquifer by residuum groundwater.

The inferred groundwater flow direction (based on groundwater gradients) in the deep bedrock aquifer is generally eastward across the facility (Figure 1-9). At the northern end of the facility near the BTF, there may be deviations in the flow direction to the northeast, whereas at the southern end of the facility near the Coke Plant, there may be deviations to the southeast. A steep gradient is noted around the Lafarge Quarry, which exerts a local effect on the potentiometric surface through groundwater extraction. Deep bedrock groundwater likely discharges to the Lafarge Quarry to the east. The pumping of water from the quarries has created hydraulic sinks in the deep bedrock aquifer, causing deep bedrock groundwater to flow to the east.

Figure 1-10 through Figure 1-12 show the November 2014, February 2015, and June 315 potentiometric surface maps for SMA 4. The groundwater flow in SMA 4 is generally towards the east as presented in the figures.

1.5.5 Ecological Setting

ERP Coke is a large, active, industrialized facility. Generally, the southern three fourths of the property is occupied by buildings and structures associated with the coke manufacturing process, the FCP, as well as raw materials (coal), roads, railways, and active large vehicles (rail cars). The

only area on the facility where industrial activity is less extensive is at the northern end, which is occupied by the active BTF and various land disposal areas that have been relatively undisturbed in recent years. Terrestrial and aquatic habitats in this area are supportive, to varying degrees, of populations of terrestrial and aquatic plants and animals. FMC, which is immediately north of the facility boundary, receives treated wastewater discharge via ERP Coke's NPDES-permitted outfall. FMC has a U.S. Fish and Wildlife Service (USFWS) designated water use.

1.5.5.1 Terrestrial Habitats

Terrestrial habitats are present at this facility and support a variety of plants, as well as various invertebrates, birds, and mammals. The terrestrial habitats are dominated by grasses, scrub-shrub, vines, saplings, and deciduous trees. Wildlife noted on the site includes several bird species (hawks, vultures, sparrows, and songbirds), small mammals (rabbits, foxes, and beavers), and frogs. SWMUs that have terrestrial habitat include SWMUs 23, 24, 25, 38, 39, 40, and 41. The BTF, located at the northern end of the facility, is characterized by a wooded area surrounding SWMUs 23, 40, and 41, the open scrub-shrub area of SWMU 24, and maintained grasses throughout the developed process areas. Surrounding SWMU 25 from the western edge of SWMU 38 to the property boundary to the west, the property is characterized as a riparian zone. SWMUs 38 and 39 are characterized as disturbed land containing low-diversity vegetation. The southern areas of the property, which are highly industrialized, contain no terrestrial habitat supportive of plant or wildlife communities. None of the SWMUs described above are located within the boundaries of SMA 4.

1.5.5.2 Aquatic Habitats

Aquatic habitats are present at SWMUs 13, 22, and 25, as well as at FMC, and support a variety of plants, invertebrates, fish, birds, and small mammals. Wetland areas have developed in storm water collection areas such as the southern end of SWMU 22. The SWMU 40 and SWMU 22 discharge into FMC via an outfall area at the northern end of the BTF. Evidence of aquatic flora and fauna, including cattails, willows, soft rushes, water oaks, frogs, small- and large-bodied fish species, and macroinvertebrates, can be found in the aquatic habitats onsite and in adjacent FMC. None of the SWMUs described above are located within the boundaries of SMA 4.

1.6 Evaluation of Previous Data from the SWMUs and AOCs in SMA 4

Other than in AOC B, surface soil (0-1 foot) samples were not collected in SMA 4 because the areas not containing structures were covered by concrete or asphalt surfaces. Based on a review of the previous reports submitted for the site, subsurface samples were collected from the areas where there was the potential for a release to the soil. Nineteen groundwater wells were placed in and around SMA 4. The spacing of the wells is such that if a release occurred in SMA 4, it should be detected by the monitoring well network.

1.6.1 Main FCP Area

The main portion of the FCP consists of SWMUs 26, 27, 28, 29, 30, 31, 32, 33, 34, 36, 42, and AOC D. A description of the processes in the FCP is included in Section 1.4. Soil samples were collected from a total of 74 locations designated CM-SB0001 through CM-SB0013, CM-SB0015 through CM-SB0063, 26-SB0001, 26-SB0002, 27-SB0001, 27-SB0002, 29-SB0001, 29-SB0002, 31-SB0001, 31-SB0002, MW-52, MW-53, MW-54, and MW-55 during the previously conducted RFIs. There are a total of eighteen monitoring wells located in and around SMA 4 designated MW-49S, MW-49D, MW-50 through MW-56, MW-70 through MW-72, MW-77, MW-78, MW-80, MW-81, MW-89, and MW-90. These wells have been sampled three times from April 2013 through November 2013.

IM is also being conducted in the area east of the main FCP area. The IM includes hydraulic control via pump and treat methods of AOC D and a VI Study in the area offsite to the east of the main FCP area has been completed.

1.6.2 SWMU 35 – Mineral Wool Piles

The Mineral Wool Piles are SWMU 35. The mineral wool piles are pieces and shots of mineral wool resulting from the manufacturing process. The mineral wool is a salable product that ERP Coke markets. Due to site knowledge of the manufacturing process and raw materials, the mineral wool chemical composition is relatively uniform. On May 17, 2012, the USEPA collected eight samples from various portions of SWMU 35. ERP Coke collected splits of the samples the USEPA collected.

1.6.3 AOC B – Drainage Ditch next to Shuttlesworth Drive and 35th Avenue

AOC B is a drainage ditch that runs along the north side of 35th Avenue and FL Shuttlesworth drive inside of the facility property boundary. Soil/sediment samples were collected from this ditch are part of preparing this CMS. The sampling program and results from AOC B are presented in Section 2.0.

2.0 SOIL SAMPLING PROGRAM AOC B

Soil sampling was not previously conducted in AOC B; therefore, a soil sampling program was conducted to obtain representative surface soil (0-1 foot depth interval) samples in AOC B.

2.1 Soil Sample Collection

On December 8, 2015, Terracon collected ten surface soil samples (designated SBB001 through SBB010) in AOC B using stainless steel trowels and spoons. The soil boring locations are shown on Figure 2-1. Boring logs are included as Appendix C.

Prior to initiation of sampling activities and between samples, the trowels and spoons were decontaminated in accordance with the approved QAPP. An equipment blank was collected to provide quality assurance that the sampling equipment was adequately cleaned. Field blanks and trip blanks were submitted to the laboratory for analysis with the soil samples to provide quality assurance that external contaminants were not introduced into the samples during collection or transport.

This sampling was conducted by a Terracon geologist, Mr. Eric Reardon. Surficial samples were collected from the 0-1 foot depth interval. A representative portion of the sample interval was collected into labeled, laboratory-provided, glass jars with Teflon-lined lids for submission to the analytical laboratory.

The soil samples were submitted under chain-of-custody to TestAmerica in Arvada, Colorado, for analysis of volatile organic compounds (VOCs) per USEPA Method 8260B, semi-volatile organic compounds (SVOCs) per USEPA Method 8270D, and polynuclear aromatic hydrocarbons (PAHs) per EPA Method 8270CSIM.

The soil samples collected on December 8, 2015, did not get analyzed by the laboratory for PAHs by EPA Method 8270 and were out of holding time when this error was noticed. Therefore, Terracon collected additional surficial soil samples on January 19, 2016 from locations immediately adjacent to the initial sample locations and submitted them to TestAmerica for analysis of PAHs by EPA Method 8270SIM.

2.2 Data Review and Validation

The laboratory conducted an initial data review and validation according to the laboratory QA manual. Data validation included application of data qualifiers to the analytical results based on adherence to method protocols and QA/QC limits. A discussion of applied data qualifiers is included within the case narrative of the analytical report for each sample delivery group. Data meeting *analytical* validity requirements set by the analytical method and the fixed-laboratory were further reviewed against the project-specific DQOs. This data validation was performed by a

qualified Terracon professional outside of the project implementation chain-of-command, in accordance with the Terracon Corporate Quality Program Manual and this project's DQOs.

Items reviewed included the following components:

- Completeness Check;
- Chain of Custody (signatures, sample conditions, preservatives, sampling handling/filtering);
- Holding Times;
- Random check (10-20%) of Initial and Continuing Calibration;
- Review of Quality Control Summaries including negative control (blanks) and positive control (LCS);
- Review of Sample Specific Controls (replicates, matrix spikes, surrogates, tracers/ yields);
- Overall PARCC assessment.

Data quality assessment (DQA) criteria were used to evaluate the quality of the field sampling efforts and laboratory results for compliance with project DQOs. The DQA criteria are expressed in terms of analytical precision, accuracy, representativeness, completeness, and comparability (PARCC).

Precision: is a measure of the reproducibility of analyses under a given set of conditions compared to the criteria of the individual laboratory's Quality Assurance Manual.

Matrix precision is calculated using equation (1).

$$RPD = \frac{|D_1 - D_2|}{(D_1 + D_2)/2} \times 100, \quad (1)$$

where,
RPD = Relative Percentage Difference
D1 = First sample value
D2 = Second sample value (duplicate)

An RPD within the method-specific control limit indicates satisfactory precision in a measurement system. For these sampling events, duplicate results were predominantly in control.

Accuracy: is a measure of the bias that exists in a measurement system compared to the criteria of the individual laboratory's Quality Assurance Manual.

For accuracy analysis; the percent recovery is calculated using equations (2) and (3).

$$LCS = \frac{Amount\ of\ Spike\ Analyte\ Detected}{Known\ Amount\ of\ Spike\ Analyte\ Added} \times 100, \quad (2)$$

LCS = Laboratory Control Sample

$$MS\ (or\ MSD) = \frac{Total\ Amount\ of\ Analyte\ Detected - Amount\ of\ Analyte\ Detected\ in\ Sample}{Known\ Amount\ of\ Spike\ Analyte\ Added} \times 100 \quad (3)$$

MS (or MSD) = Matrix Spike (or Matrix Spike Duplicate)

Accuracy results for methods and matrices are predominantly in control. For those results in which MS/MSD were out of control; accuracy and precision were generally demonstrated by acceptable LCS/LCSD analysis. Therefore, overall accuracy for these sampling events was acceptable.

Representativeness: Sample data are believed to accurately depict selected site conditions prevailing at the time of sample collection based on a general conformance to established protocols as established by TSOPs, laboratory QA/QC protocol, and/or USEPA/ADEM standard operating procedures.

Comparability: Samples were reported in industry-standard units. Water reporting units were micrograms per liter (µg/L) or milligrams per liter (mg/L). Analytical protocols for the methods were adhered to (with the exceptions noted in the reports) and analytical results are considered comparable.

Completeness: the measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under "normal" conditions. This goal will be accomplished if 95% of design samples are taken and found to be qualified for precision and accuracy. Completeness objectives were met, understanding that results qualified with U, UJ or J are usable to meet the project objectives of these sampling events.

The soil data are of acceptable quality and are considered usable to support the project objectives for this sampling event when used in accordance with the validation qualifiers. The laboratory data will be submitted electronically to EPA Region 4 per the steps found on http://www.epa.gov/region4/superfund/allresource/edd/edd.html.

2.3 Soil Boring Sample Analytical Results

Summaries of the soil sample analytical results are presented on Tables 1 and 2 in Appendix A. The soil sample analytical results were compared to the EPA Regional Screening Levels (RSLs, November 2015) for Industrial Soil with a target cancer risk of 1 x 10-6 and an HI of 1.0.. The soil sample results were used in portions of the site-specific baseline human health risk assessment (HHRA) found below in Section 3.0. The results of the soil sample analytical data are as follows:

2.4 VOC Analysis

No VOCS were detected above the laboratory reporting limits in any of the soil samples analyzed, and none of the reporting limits exceeded the RSLs.

2.5 SVOC Analysis

The following SVOCs were detected in at least one sample at concentrations exceeding the RSL from the listed surficial soil samples:

- Benzo(a)anthracene – SBB002
- Benzo(a)pyrene – SBB001, SBB002, SBB005, SBB006, SBB008, SBB010
- Benzo(b)fluoranthene – SBB001, SBB002
- Dibenz(a,h)anthracene – SBB001, SBB002
- Ideno(1,2,3-cd)pyrene – SBB001, SBB002

2.6 PAH SIM Analysis

The following PAH SIM were detected in at least one sample at concentrations exceeding the RSL from the listed surficial soil samples:

- Benzo(a)anthracene – SBB002
- Benzo(a)pyrene – SBB001, SBB002, SBB006, SBB009
- Benzo(b)fluoranthene – SBB001, SBB002
- Dibenz(a,h)anthracene – SBB001, SBB002, SBB006
- Ideno(1,2,3-cd)pyrene – SBB002

2.7 RCRA Metals Analysis

The following RCRA metals were detected in at least one sample at concentrations exceeding the RSL from the listed surficial soil samples:

- Arsenic – SBB001, SBB002, SBB3003, SBB004, SBB005, SBB006, SBB007, SBB008, SBB009, SBB010

2.8 Groundwater Leachability

Site Specific Soil Screening Levels (SSLs) for leaching to groundwater were presented in Appendix G of the Phase III RFI prepared by CH2MHILL. The basis of the approach is that infiltrating precipitation has the potential to leach chemicals from the soil to the uppermost groundwater. The leachate is then diluted by the lateral flow within the groundwater-bearing unit. The approach assumes that a hypothetical future groundwater user is present on the immediate

downgradient boundary of the site. Potable groundwater use is assumed for the hypothetical future scenario.

SSLs are inherently conservative estimates that are based on a number of assumptions including:

- The SSL evaluation assumes that there is uniform distribution of COCs across an entire "site" and that groundwater is or could be used on the immediate downgradient edge of the site.
- No degradation of the chemicals is included as the chemicals are transported vertically through the vadose zone or lateral transport in the groundwater bearing unit.
- The leaching of chemicals from soil are dependent on chemical and site specific physical conditions. Leachate concentrations can either be over or underestimated.
- The initial screening of chemicals assumes an infinite source mass and therefore may violate mass limit constraints. Additional evaluation may be required to quantify the chemical mass in the source area or areas to understand mass limit constraints.

The 95% UCL for SMA 4 subsurface soil concentrations were screened against the groundwater protection soil screening levels (GWP SSLs). The GWP SSLs are used to evaluate chemical concentrations in subsurface soil as a means of determining if measured site soil concentrations present a potential threat for future contamination of groundwater. GWP SSLs used for screening of SMA 4 subsurface soil chemical concentrations were derived in the Phase III RCRA Facility Investigation Report (Arcadis & CH2MHill, 2009). If SSLs were not available in the Phase II report, SSLs provided on USEPA's RSL table (Nov. 2015) were used. The results of the screening are discussed in Section 4.2.2.

3.0 BASELINE RISK ASSESSMENT SMA 4

The purpose of this Baseline Risk Assessment is to calculate theoretically potential adverse health and ecological effects (current or future) caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases (i.e., under an assumption of no action) at SMA 4 based on highly protective assumptions that are very unlikely to represent reality. The baseline risk assessment contributes to the site characterization and subsequent development, evaluation, and selection of appropriate response alternatives. The results of the baseline risk assessment are used to help determine whether additional response action may be warranted at the site, to modify preliminary remediation goals, to help support selection of the "no-action" remedial alternative, where appropriate, and to document the magnitude of risk at a site, and the primary causes of that risk (USEPA, 1989). Sections 3.1 through 3.8 comprise the Baseline Human Health Risk Assessment (HHRA). The tables for Section 3.0 are located under the Tables tab at the back of this report.

3.1 Overview of the Human Health Risk Assessment (HHRA)

The purpose of this Baseline Human Health Risk Assessment (HHRA) is to evaluate the theoretically potential adverse effects to humans that may result from exposure to chemicals in the environment at SMA 4 based on highly protective assumptions that are very unlikely to represent reality. The overall risk assessment approach for the HHRA follows the US Environmental Protection Agency's (USEPA's) standard, four-step human health risk assessment paradigm, including: Hazard Identification, Exposure Assessment, Toxicity Assessment, and Risk Characterization. These steps are performed according to methodology and procedures published by USEPA in various guidance documents and databases, including (but not limited to):

- USEPA's *Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part A).* (1989)
- USEPA Region 4's *Human Health Risk Assessment Supplemental Guidance* (2014)
- USEPA's *RAGS Part E, Supplemental Guidance for Dermal Risk Assessment (*2004)
- USEPA's *RAGS Part F, Supplemental Guidance for Inhalation Risk Assessment (*2009)
- USEPA's *RAGS Part B, Development of Risk-Based Preliminary Remediation Goals* (1991)
- USEPA's OSWER Memo, *Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors* (2014)
- USEPA's *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (2002a)
- USEPA's *Regional Screening Levels (RSLs)* (November 2015)
- USEPA's on-line toxicity database, *Integrated Risk Information System (IRIS)*
- USEPA's *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (2002b)

- USEPA's *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposures to Carcinogens* (2005)

Specific subtasks performed for this HHRA include:

- Data Collection, Evaluation, and Selection of Chemicals of Potential Concern
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization
- Uncertainty Analysis
- Derivation of Remedial Goal Objectives

Descriptions presented below summarize procedures and methodologies utilized to accomplish each of the subtasks of the bullet list above.

3.2 Data Collection, Evaluation, and Selection of Chemicals of Potential Concern

Surface soil data was collected as described in Section 2.0, above. Subsurface soil data collected during previously submitted investigations were validated prior to this submittal and are used in this HHRA. Data used to evaluate the mineral wool piles were collected on May 17, 2012 by the USEPA. Data used to evaluate risks from exposure to groundwater beneath SMA 4 has been more recently collected, during the last six sampling events from February 2014 through February 2016. Analytical results are presented in Appendix A and the sampling locations for samples are shown on Figure 2-1 and Figures 3-1 through 3-3.

As discussed above, surface soil sample collection was not possible in SWMU 26, SWMU 27, SWMU 28, SWMU 29, SWMU 30, SWMU 31, SWMU 32, SWMU 33, SWMU 34, SWMU 36, and SWMU 42 because the area was either buildings or paved areas. Thus, soil analytical data in these SWMUs are subsurface soil collected at depths down to 15 ft. Surficial soil samples were collected in AOC B from the 0 to 1-foot depth interval.

Chemical data are summarized and tabulated to show pertinent sample statistics for each medium, including: the minimum and maximum concentrations; the appropriate upper confidence limit (UCL) about the mean; and frequency of detection. The USEPA software ProUCL version 5.0.0 (USEPA, 2013) was utilized to determine the chemical data distributions to provide the most appropriate UCLs. Censored data (reported at concentrations below detection limits) were retained and evaluated as described in ProUCL.

Chemicals of potential concern (COPCs) are chemicals retained for quantitative evaluation in the risk assessment as they may present health threats to receptors. COPCs were selected using the screening criteria as described in RAGS Part A (USEPA, 1989) for all chemicals detected at

least once. For selection of soil COPCs, USEPA industrial exposure Regional Screening Levels (RSLs) (USEPA, Nov. 2015a) were used to screen for COPCs by comparing the maximum detected chemical concentrations to the more conservative of the cancer effects RSL, at the 1E-06 level, or the noncancer effects RSL, at the 0.1 level, whichever was less. This ensures that a conservative approach to COPC selection has been performed. COPCs selected for SMA 4 surface soil are presented in Table 3-1 and COPCs selected for subsurface soil are presented in Table 3-2.

An additional screening was performed, aside from that used for COPC selection for the risk assessment. Groundwater protection soil screening levels (SSLs) were used to evaluate chemical concentrations in subsurface soil as a means of determining if measured site soil concentrations may potentially leach to groundwater. SSLs used for screening of SMA 4 subsurface soil chemical concentrations were derived in the Phase III RCRA Facility Investigation Report (Arcadis & CH2MHill, 2009). If SSLs were not available in the Phase II report, SSLs provided on USEPA's RSL table (Nov. 2015a) were used. Chemical screening against groundwater protection SSLs is shown on Table 3-2. Multiple chemicals have a maximum detected concentration that exceeds its SSL.

To further refine the list of chemicals exceeding their SSLs, a statistical analysis was performed to determine the 95% upper confidence limit (UCL) value, which represents a conservative upper bound on the arithmetic mean for the data. To calculate the 95% UCL, USEPA's software, ProUCL v. 5.0 (2013), was used; the resulting ProUCL output is found in Appendix B. The appropriateness of using the 95% UCL to better represent environmental data is discussed further below in Section 3.3.2. Table 3-3 presents a second comparison using the 95% UCL compared to the SSLs for just those chemicals that demonstrated an exceedance. By doing this comparison, the number of chemicals is reduced, as indicated on Table 3-3

It is also evident from reviewing Table 3-3, that multiple chemicals were detected at a very low frequency. For example, 1,1,2-trichloroethane, 1,2-dichloropropane, and chloroform are only detected once out of 177 samples. It is appropriate in this instance, to follow USEPA guidance and eliminate chemicals that are infrequently detected, using the cutoff of 5% detections (USEPA, 1989). The chemicals shown in exceedance on Table 3-3 can be further refined to just those that are detected at a rate greater than 5%, resulting in the following list of chemicals potentially available for leaching from soil to groundwater.

- Benzene
- Chlorobenzene
- Methylene chloride
- Toluene
- Vinyl chloride
- 1-Methylnaphthalene
- 3 & 4 Methylphenol

- 4-Methylphenol (p-cresol)
- Benzo(a)anthracene
- Benzo(b)fluoranthene
- Carbazole
- Dibenzofuran
- Naphthalene
- Arsenic

Further evaluation and discussion of the potential for chemicals detected in subsurface soil to leach to groundwater is presented in Section 4.2.2.

Another area in SMA 4 was evaluated separately, the Mineral Wool Pile. The material in the Mineral Wool Pile is not soil, instead it is a product being stored on-site until it is sold. Because of the unique nature of this material, it is evaluated separately. In this case, maximum detected chemical concentrations of the mineral wool were screened against industrial soil RSLs to select COPCs evaluation of the industrial worker. This screening approach is very conservative because the mineral wool is not soil and industrial workers do not regularly work on the Mineral Wool Pile. The mineral wool is also screened against residential soil RSLs as a conservative approach to select COPCs used to evaluate the hypothetical risk of an off-site resident exposed to mineral wool, should the material become transported from the pile to air and then dispersed by wind. The conservative nature of this approach for evaluating both of these pathways is discussed further below in Section 3.3.1.

Analytical data pertaining to samples collected from the Mineral Wool Pile include splits, where EPA obtained the split sample and analyzed the material at a separate laboratory. Because all of this data provides a more comprehensive characterization of the mineral wool, all available analytical data is pooled into one population and maximum detected concentrations, regardless of whether the data resulted from primary samples or split samples, were used to compare to RSLs for COPC selection. COPCs selected for the Mineral Wool Pile are presented in Table 3-4.

To develop a list of COPCs for chemicals to be evaluated for human health effects from exposure to groundwater via direct contact pathways, the USEPA RSLs for tapwater (USEPA, Nov. 2015) were used. Chemicals detected in groundwater were retained as COPCs if the maximum detected concentration was found to exceed its tapwater RSL. In the event a tapwater RSL was not available, the MCL was used. COPCs selected for groundwater are presented in Table 3-5.

To develop a list of COPCs for chemicals to be evaluated for the vapor intrusion pathway, screening levels were obtained from USEPA's Vapor Intrusion Screening Level (VISL) Calculator (USEPA, 2015b). COPCs were selected for evaluation of vapor intrusion from on-site groundwater if the maximum concentration was found to exceed the VISL screening level, as presented on Table 3-5.

3.3 Exposure Assessment

The objectives of the exposure assessment are to characterize potentially exposed human receptors at the Site, to identify actual or potential exposure pathways, and to quantify the potential exposure. Thus, the exposure assessment involves several elements, including:

- Identification of the potential receptors/exposure scenarios (as shown in the Conceptual Site Model [CSM])
- Identification of exposure routes (also in the CSM)
- Quantification of exposure point concentrations (EPCs)
- Identification of the exposure models and assumptions used to calculate daily intakes or doses

3.3.1 Receptors and Pathways Evaluated

The CSM depicts the path a contaminant could theoretically follow from environmental media to intake by the receptor. Figure 3-4 presents the CSM for current SMA 4 soil and groundwater exposure scenarios, and Figure 3-5 presents the CSM for theoretically potential future exposure scenarios. To be highly protective, this HHRA will consider an exposure pathway to be complete as shown on the CSMs even though the occurrence of the theoretically potential future exposure scenarios may be highly unlikely. One additional area has been evaluated independently from SMA 4, the Mineral Wool Pile. Because of unique aspects of this material, and because it is a product and not environmental media, this area has been evaluated separately, and thus, a CSM applicable to just the Mineral Wool Pile has been developed as Figure3-6.

Discussion is presented below for each receptor and the conditions of their potential exposure scenarios. The specific exposure parameters used to calculate assumed chemical intakes, including exposure frequencies and durations for each receptor and pathway to be evaluated in this HHRA are summarized in Table 3-6.

Current and Future Industrial/Commercial Workers

Current and future industrial/commercial workers are assumed to be adult, full-time workers who may be exposed to on-site contaminants. Industrial/commercial workers are assumed to be long-term employees who work at the facility 40 hours/week, 250 days/year, for a duration of 25 years. Their exposure to soil may be through ingestion, dermal absorption, or inhalation of dust particles. Given the nature of organic contaminants in soil, these workers may also be exposed to volatiles in ambient air. Both the current and future industrial worker receptor is evaluated on the assumption of potentially being exposed to surface soil, from a depth of 0 to 1 ft, and, as potentially being exposed to subsurface soil (2 - 15 ft), in a situation where periodic, limited trenching or utility work might be conducted. It is assumed that this latter scenario involves a receptor exposed to subsurface soil in such a manner for up to one work-week per year, each year over the 25 year duration. The worker is assumed to be exposed to soil via incidental ingestion, dermal absorption,

and inhalation; hence, this HHRA considers these pathways complete and they are evaluated in this risk assessment.

Current and future industrial/commercial workers are also evaluated for exposure to the Mineral Wool Pile. For this evaluation, the inhalation pathway of the industrial worker receptor is evaluated as being potentially exposed to this material for 8 hours/day, 250 days/year, over a 25 year duration. This is a conservative approach as the mineral wool is not soil, and the mineral wool pile develops a crusty nature at the surface that acts to limit the material from being dispersed into air. To evaluate ingestion and dermal absorption pathways, another approach is used. The industrial workers at the ERP Coke facility only rarely perform tasks to manage the mineral pile in such a way that potential contact may occur. The Mineral Wool Pile sits idle, without requiring any attention, until sales occur. To evaluate the industrial worker for potential direct contact with the mineral wool, it is conservatively assumed that this receptor may perform some type of management of the material for 3 days/month, 8-hours/day, over the duration of exposure. Pathways shown as being complete for this receptor on Figure 3-6 include mineral wool ingestion, mineral wool dermal absorption, and inhalation of particles and volatile organics.

Groundwater is not currently used at the facility for any potable purpose, nor is it anticipated being used in the future. An ordinance has been passed by the City of Birmingham prohibiting groundwater use for potable purposes. Thus, the groundwater pathway is currently incomplete for, and therefore does not present a risk to, industrial workers, and so the current industrial worker is not evaluated for exposure to groundwater by direct contact. However, in the very unlikely event that groundwater may be available for use sometime in the future, the future industrial worker is evaluated for hypothetical groundwater ingestion and for dermal absorption and inhalation of volatiles while showering. To quantify the latter pathway, the worker is assumed to be in the shower for 20 minutes, remaining in the shower room for 15 minutes afterwards. During this time, the receptor may be exposed to chemicals in water via dermal contact and inhalation of any vapors that may form and linger in the air.

Because some portions of the site are underlain by volatile organic contaminants in groundwater, there also may be a potential for the vapor intrusion pathway to be complete. If this is the case, workers may be exposed to volatiles via the inhalation pathway while working indoors, both currently and in the future. Evaluating the current industrial worker for vapor intrusion is a very conservative approach and is further discussed in Section 3.6, Uncertainty Analysis. Currently, USEPA is re-evaluating their recommended vapor intrusion guidance. USEPA's Vapor Intrusion Screening Level calculator (2015b), is the most current, published risk tool, and is utilized to estimate risks to receptors working in buildings who may be exposed to VOCs.

To summarize, the following pathways are quantitatively evaluated for current industrial workers:

- Soil ingestion
- Soil dermal contact

- Inhalation of soil particles
- Inhalation of VOCs from soil in ambient air
- Mineral wool ingestion
- Mineral wool dermal contact
- Inhalation of mineral wool particles
- Inhalation of VOCs from mineral wool in ambient air
- Inhalation of vapors inside buildings

The following pathways are quantitatively evaluated for future industrial workers:

- Soil ingestion
- Soil dermal contact
- Inhalation of soil particles
- Inhalation of VOCs in ambient air
- Mineral wool ingestion
- Mineral wool dermal contact
- Inhalation of mineral wool particles
- Inhalation of VOCs from mineral wool in ambient air
- Inhalation of VOCs inside buildings
- Groundwater ingestion
- Groundwater dermal contact while showering
- Inhalation of VOCs while showering with groundwater

Current and Future Construction Workers

Construction activities may occur on-site such that a construction worker could be exposed to site contaminants. Construction workers are not ERP Coke employees, they would be working for a separate company under a contract for limited construction work. Construction workers may be exposed to soil chemicals via ingestion, dermal absorption, and by the inhalation of contaminated dust or VOCs in ambient air. Given that surface soil samples have not been collected during previous investigations of the facility, because of the general absence of such soils in this SMA (as discussed above for the industrial/commercial worker), surface soil samples were collected from the area designated as AOC B. Construction workers are assumed to be exposed to soils at depths from 0 to 1 feet as well as from 2 to 15-feet, although the exposure scenarios for these two depths would likely differ. Construction workers exposed to surface soil would most likely occur only while performing short-term work at shallow depths for such tasks as utility maintenance. For this scenario, construction workers are conservatively assumed to do such utility work at SMA 4 for 3 days/week, 8 hours/day, over the duration of exposure. Alternatively, a construction worker exposed to soil at depths of typical building excavations (15 ft depth), may be involved in more complex and lengthy projects. Hence, a construction worker is evaluated as being exposed to subsurface soil for 250 days/year, 8 hours/day, over a one-year duration of exposure.

While construction workers are not likely to be exposed to groundwater for potable purposes, they may be exposed during trenching if shallow groundwater is encountered. For those areas where groundwater may be shallow enough to be encountered, construction workers are evaluated for their exposure to groundwater via dermal absorption and for the inhalation of VOCs that may collect in the trench. The State of Virginia Department of Environmental Quality (VDEQ) provides a model on their web site to derive the VOC concentration in air that is used to evaluate the inhalation pathway in a trench (VDEQ, 2010).

To summarize, the following pathways are quantitatively evaluated for current and future construction workers:

- Soil ingestion
- Soil dermal contact
- Inhalation of soil particles
- Inhalation of VOCs in ambient air
- Groundwater dermal contact while trenching
- Inhalation of VOCs from groundwater while trenching

Current and Future On-Site Trespassers

The ERP facility is a secure property; however, the potential for trespassers to enter the site can never be 100% eliminated. Risks to an adolescent trespasser are evaluated for an individual that may enter the site infrequently, up to 12 days/year, for 1 hour/day, from age 7 to 16. The trespasser is potentially exposed to surface soil, via soil ingestion, dermal absorption, and inhalation of dust particles and volatiles in ambient air. Given the security at this facility, these exposure assumptions are highly protective and unlikely to occur in reality; hence, this HHRA very likely significantly overestimates risk to trespassers.

Current and Future Off-Site Residents

Current and future off-site residents are evaluated for exposure to contaminated media at the ERP Coke facility, if a complete pathway may exist. In the case of the Mineral Wool Pile, it is theoretically possible that material from the pile may become airborne, disperse in wind, and migrate off-site. In that event, off-site residents in the vicinity may be exposed. Because of this potentially complete pathway, adult and child off-site residents are evaluated for inhalation exposure from contaminants present in the Mineral Wool Pile. Exposure parameters utilized to evaluate off-site residents are those recommended by USEPA (USEPA, 2014) as 24 hours/day, 350 days/year, over a duration of 26 years for adults and 6 years for children. This approach is very conservative, as the mineral wool is not soil and the mineral wool pile develops a crusty nature at the surface and vegetative cover that limits its ability to become airborne (as discussed further in Section 3.6 Uncertainty Analysis).

It is also possible that groundwater migrating off-site may flow beneath homes in the vicinity of the facility. In that event, the presence of volatile organics in groundwater may intrude into these

homes, making the inhalation pathway via vapor intrusion potentially complete. Actual vapor intrusion sampling has been performed during the Vapor Intrusion Study completed for off-site residences for the groundwater plume associated with SMA 4. The Vapor Intrusion Characterization Report (Revision 1.0) was submitted to EPA on February 5, 2015. The summary and conclusions of the VI Report were:

The multiple lines of evidence showed that no further action of any kind is needed or warranted with respect to the potential for vapor intrusion, and those lines of evidence include that:

- Crawlspace sampling benzene results indicate that no further action is needed or warranted with respect to potential vapor intrusion because:
  - these results are below or consistent with background ambient air concentrations,
  - this consistency with background indicates that vapor intrusion is not occurring or presents essentially no potential to increase concentrations in indoor air, and that the crawlspace sampling benzene results are driven by background ambient air concentrations,
  - trends in soil vapor and crawlspace sampling results support the conclusion that crawlspace sample benzene results are driven by background ambient air concentrations, and
  - EPA has already determined that the concentrations reflected in the crawlspace sampling benzene results (individually and on average) fall within EPA's acceptable risk range.
- Soil vapor benzene results indicate that no further action is needed or warranted with respect to potential vapor intrusion because the results show that the operation of the hydraulic control system is controlling soil vapor concentrations such that there is no or minimal apparent risk of vapor intrusion.
- During the most recent groundwater sampling event (February 2014), no VOC concentrations in excess of the MCLs were noted in any off-site groundwater monitoring well, demonstrating (1) the effectiveness of the hydraulic control system on plume control and (2) further reduced potential for vapor intrusion at off-facility properties.
- No other constituents exceed the screening level in the crawlspace samples or in the soil vapor samples.

EPA issued an *Approval to remove Soil Vapor Monitoring Points* letter dated July 2, 2015. This letter concluded that no further action was needed with respect to potential vapor intrusion and that the soil vapor points could be abandoned. The vapor points were abandoned on October 14, 2015, in accordance with the EPA-approved Work Plan.

Thus, the Vapor Intrusion Study showed, and EPA agreed, that no further attention to vapor intrusion by way of study or corrective action was warranted. Thus, further evaluation of this pathway to offsite residents in this CMS is not needed. In particular, it should be noted that the Vapor Intrusion Study results demonstrate that the vapor intrusion pathway is very likely entirely incomplete because any crawlspace detections of COPCs were consistent with and generally below the background concentrations of those COPCs in ambient air. Consequently, vapor intrusion risk to off-site residents is not considered further in this CMS.[1]

To summarize, the following pathway is quantitatively evaluated for off-site residents:

- Inhalation of constituents associated with the Mineral Wool Pile

3.3.2 Exposure Point Concentrations

An exposure point is a location where, for the purposes of risk assessment, a receptor is assumed to move at random, throughout the duration of exposure, and where contact with an environmental medium is equally likely at all sub-locations. The chemical concentration developed to represent that exposure is termed the exposure point concentration (EPC). Because of the randomness assumed for exposure, an EPC is derived as an estimate of the true arithmetic mean concentration of a chemical in a medium at an exposure location. However, because the true arithmetic mean concentration cannot be calculated with certainty from a limited number of measurements, USEPA recommends that the 95th percentile upper confidence limit (UCL) of the arithmetic mean at each exposure point be used when calculating exposure and risk at that location (USEPA, 1992). Further, if the 95% UCL exceeds the highest detected concentration, the highest detected value is used instead (USEPA, 1989).

USEPA has developed statistical software to aid the development of EPCs for a chemically contaminated site. This software, ProUCL version 5.0.0 (USEPA, 2013) was utilized to develop EPCs for each environmental media. The EPC selected was either the 95%UCL or the maximum detected concentration, whichever was less. In some cases, ProUCL cannot compute a UCL; for example, with too few sample results or too few detections in a large data set. In those cases, the maximum chemical concentration was selected as the EPC. EPCs are presented for the COPCs of SMA 4 surface soil in Table 3-7 and subsurface soil in Table 3-8. EPCs for the mineral wool are presented in Table 3-9. EPCs for on-site groundwater beneath SMA 4 are presented on Table 3-10.

[1] Full consideration of this pathway in this HHRA would have confirmed this conclusion, in any event. Based on the sampling results for the off-site wells, the VISL vapor intrusion ELCR for the off-site resident is within EPA's acceptable risk range of 1E-06 to 1E-04, and the vapor intrusion HI for the off-site resident is far below the level of 1.0.

Because some EPCs are represented by UCLs, as calculated by ProUCL, the printouts from ProUCL are included in the very beginning of Appendix B. Separate print-outs are provided for surface soil, subsurface soil, the Mineral Wool Pile, and groundwater.

Once the EPCs were calculated for each media in each exposure area, a receptors' chemical intake was calculated, as described below.

3.3.3 Estimating Chemical Intake

Methodology to estimate chemical intake from the various exposure pathways is described further below.

3.3.3.1 Intake of Chemicals from Exposure to Soil and Mineral Wool

The equations presented below are those recommended by USEPA for intake specifically in regard to soil. As this is the only approach available for evaluating intake of particles, mineral wool intake is quantified using these same equations. This is a conservative approach, as the material in the Mineral Wool Pile develops a crusty nature at the surface that will act to limit its intake.

Ingestion

Average daily chemical intake for the incidental ingestion of soil is calculated by use of the following formula (USEPA, 1989):

$$DI_{Ingestion} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

where:

$DI_{Soil\text{-}Ing}$ = average daily chemical intake via soil ingestion (mg/kg-day)
CS = chemical concentration in soil (mg/kg)
IR = ingestion rate (mg soil/day)
CF = conversion factor (10^{-6} kg/mg)
FI = fraction ingested from contaminated source (unitless)
EF = exposure frequency (days/year)
ED = exposure duration (years)
BW = body weight (kg)
AT = averaging time (period over which exposure is averaged, days)

Spreadsheets depicting the calculated assumed chemical intake from ingestion of surface soil by industrial workers, construction workers, and adolescent trespassers are presented in Appendix B on Tables B1.1, B1.2, and B1.3, respectively. Calculated assumed chemical intake via ingestion of subsurface soil by industrial workers and construction workers presented on Tables

B1.4 and B1.5. Calculated assumed chemical intake via ingestion of mineral wool by industrial workers are presented on Table B1.6.

Inhalation

For the purposes of evaluating a receptor's assumed exposure to chemicals in ambient air, as either volatiles or adsorbed to particles, the development of the exposure concentration (EC) in air, as recommended by USEPA's *RAGS Part F, Guidance for Inhalation Risk Assessment* (USEPA, 2009), must be performed. EC is calculated by modeling the contaminant concentrations (CA) in air first, following the methodology presented in USEPA's *Soil Screening Guidance* (USEPA, 2002a). EC will be determined by using the following equation:

$$EC = \frac{CA \times ET \times EF \times ED}{AT}$$

where:

EC = exposure concentration (µg/m^3)
CA = chemical concentration in air (µg/m^3)
ET = exposure time (hours/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
AT = averaging time (period over which exposure is averaged, days)

The chemical concentration in air (CA) term will be calculated as follows:

$$CA = CS \times [(1 / PEF) + (1 / VF)]$$

where:

PEF = Particle emission factor (m^3/kg); 5.70E+09 m^3/kg (default value) (USEPA, 2002a)
VF = Volatilization factor (m^3/kg).

Additionally, the following equation was used to derive VF, as described by USEPA's *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (*2002).

$$VF = [Q/C \times (3.14 \times D_A \times T)^{1/2} \times CF] / (2 \times \rho_b \times D_A)$$

where:

Q/C = inverse of mean concentration at center of source (g/m^2-s per kg/m^3)
D_A = apparent diffusivity (cm^2/sec)
T = exposure interval (sec)
CF = conversion factor, 10^{-4} m^2/cm^2

ρ_b = dry soil bulk density (g/cm^3) = 1.5 g/cm^3

Additionally, the following equation was used to derive D_A (USEPA, 2002).

$$D_A = [(\theta a^{10/3} \times Di \times H') + (\theta w^{10/3} \times Dw) / n^2] / [(\rho_b \times Kd) + \theta w + (\theta a \times H')]$$

where:

θa = air filled porosity (L_{air}/L_{soil}) = n - θw = 0.284
Di = diffusivity in air (cm^2/sec), chemical specific
H' = Henrys law constant, unitless, chemical specific
θw = water-filled porosity (L_{water}/L_{soil}) = 0.15
n = total soil porosity (L_{pore}/L_{soil}) = 1 - (ρ_b/ρ_s) = 0.434
Kd = soil-water partition coefficient, cm^3/g

The following equation was used to derive Kd (USEPA, 2002).

$$Kd = K_{OC} \times f_{OC}$$

where:

K_{OC} = soil organic carbon partition coefficient (cm^3 / g), chemical specific
f_{OC} = fraction organic carbon in soil (g/g), 0.006

Tables B1.7 through B1.21, in Appendix B, illustrate the calculated values for the above described parameters (Kd, Q/C, DA, and VF), resulting in CA for each COPC, for surface soil, subsurface soil, and mineral wool of SMA 4. Tables B1.22, B1.23, and B1.24 present the calculated assumed ECs for industrial workers, construction workers, and adolescent trespassers exposed to surface soil of SMA 4, respectively. Tables B1.25 and B1.26 presents the calculated assumed EC for industrial workers and construction workers exposed to subsurface soil of SMA 4. Tables B1.27, B1.28, and B1.29 presents the calculated assumed EC for industrial workers, adult residents, and child residents, relative to the theoretically potential pathway from the Mineral Wool Pile.

The child resident receptor presents a unique scenario with respect to quantifying assumed exposure. This receptor is evaluated for assumed exposure to chemicals that may invoke a mutagenic response. The mutagenic evaluation is discussed further below in Section 3.4.3, where it is explained that an Age-Dependent Adjustment Factor is applied for certain time periods of a child's life. These time periods are from 0 to 2 and 2 to 6 years. Because of this, intake was calculated separately for these time periods as shown on Table B1.29.

Dermal Absorption

Average daily chemical intake for dermal absorption of chemicals in soil was calculated by use of the following formula (USEPA, 2004):

$$DAD = \frac{DA_{event} \times EF \times ED \times EV \times SA}{BW \times AT}$$

where:

DAD = dermal absorbed dose (mg/kg-day)
DA_{event} = absorbed dose per event (mg/cm^2-event)
EF = exposure frequency (days/year)
ED = exposure duration (years)
EV = event frequency (events/day)
SA = skin surface area available for contact (cm^2)
BW = body weight (kg)
AT = averaging time (period over which exposure is averaged, days)

The DA_{event} term was calculated by the following formula (USEPA, 2004):

$$DA_{event} = CS \times CF \times AF \times ABS_d$$

where:

DA_{event} = absorbed dose per event (mg/cm^2-event)
CS = chemical concentration in soil (mg/kg)
CF = conversion factor (10^{-6}kg/mg)
AF = adherence factor of soil to skin (mg/cm^2-event)
ABS_d = dermal absorption fraction

Tables B1.30, B1.31, and B1.32, in Appendix B, present the calculated values for DAevent for surface soil, subsurface soil, and mineral wool, respectively. Tables B1.33, B1.34, and B1.35 present the dermal absorbed dose (DAD) for industrial workers, construction workers, and adolescent trespassers exposed to surface soil, respectively. Tables B1.36 and B1.37 presents the calculated assumed DAD for the industrial workers and construction workers exposed to subsurface soil. Table B1.38 presents the calculated assumed DAD for industrial workers exposed to mineral wool.

3.3.3.2 Intake of Chemicals from Exposure to Groundwater

Ingestion

Assumed average daily chemical intake for the ingestion of groundwater as drinking water was calculated by use of the following formula (USEPA, 1989):

$$DI_{Ingestion} = \frac{CW \times IR \times EF \times ED}{BW \times AT}$$

where:

$DI_{Ingestion}$ = average daily chemical intake via groundwater ingestion (mg/kg-day)
CW = chemical concentration in groundwater (mg/L)
IR = intake rate (L/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)

BW = body weight (kg)
AT = averaging time (period over which exposure is averaged, days)

Calculated assumed average daily chemical intake via groundwater ingestion at SMA 4 was calculated for the industrial worker and presented on Tables B2.1 of Appendix B.

Dermal Absorption

Assumed average daily chemical intake for dermal absorption of chemicals in groundwater via direct contact by industrial workers during showering, in the event groundwater is available for use at some time in the future, was calculated by use of the following formula (USEPA, 2004):

$$DAD = \frac{DA_{event} \times EF \times ED \times EV \times SA}{BW \times AT}$$

where:

for organics: $DA_{event} = Cshw \times Kp \times 2 \times FA \times SQRT(6 \times tau \times t_{event}/p)$

for inorganics: $DA_{event} = Cshw \times Kp \times t_{event}$

and

Cshw	=	CW x f x CF1 x CF2
DAD	=	dermal absorbed dose (mg/kg-day)
DA_{event}	=	absorbed dose per event (mg/cm^2-event)
Cshw	=	concentration remaining in shower water (mg/cm^3)
CW	=	chemical concentration in groundwater (µg/L)
f	=	fraction in shower water after volatilization (NA for inorganics or f = 1)
CF1	=	conversion factor (mg/µg)
CF2	=	conversion factor (L/cm^3)
Kp	=	dermal permeability coefficient in water (cm/hr)
FA	=	fraction of chemical absorbed
t_{event}	=	exposure time in shower (hr), 20 minutes
t*	=	time to reach steady-state (hr)
tau	=	lag time per event (hr)
EF	=	exposure frequency (days/year), each work day for 25 years
ED	=	exposure duration (years)
EV	=	event frequency (events/day)
SA	=	skin surface area available for contact (cm^2)
BW	=	body weight (kg)
AT	=	averaging time (period over which exposure is averaged, days)

The assumed concentration remaining in the shower after volatilization (Cshw) was calculated for COPCs in groundwater, as shown on Table B2.2, presented in Appendix B. The DAevent term was also calculated for COPCs in groundwater, with results presented on Table B2.3, in Appendix

B. The calculated assumed average daily chemical intake from dermal contact with groundwater while showering is presented on Table B2.4 in Appendix B.

The assumed average daily chemical intake for dermal absorption of chemicals in groundwater for the construction worker, who may be exposed if groundwater pools in a trench, was calculated using the following formula (USEPA, 2004):

$$ADI_{GW\text{-}Derm} = \frac{CW \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

where:

$ADI_{GW\text{-}Derm}$ = average daily absorbed chemical dose (mg/kg-day)
CW = chemical concentration in groundwater (mg/L), as represented by the EPC
SA = skin surface area available for contact (cm^2)
PC = chemical-specific dermal permeability constant (cm/hour)
ET = exposure time (hours/day)
EF = exposure frequency (days/year)
ED = exposure duration (year)
CF = conversion factor for water (1 L/1000 cm^3)
BW = body weight (kg)
AT = averaging time (period over which exposure is averaged, days)

For construction workers who may be dermally exposed to contaminants in groundwater while trenching, the same formula used for calculating the assumed dermal absorbed dose (DAD), as described just above, except that exposure parameters are selected that better reflect the skin surface area affected and the time/duration of exposure for this scenario. The construction worker is evaluated as being in contact with pooled water in a trench for 2 hours/day and 125 days/year.

The average chemical intake calculations for the construction worker can be found on Table B2.5 in Appendix B.

Inhalation

The inhalation pathways involving contaminated groundwater are primarily those that are affected by the phase change of dissolved VOCs in groundwater to vapors in air. These pathways include inhalation of vapors inside buildings from vapor intrusion, inhalation of vapors in trenches for construction workers who encounter contaminated groundwater, and individuals who may be exposed to VOCs while showering.

Industrial workers are evaluated assuming they might shower with site groundwater. Modeling is required to estimate the indoor air concentrations of VOCs from groundwater while showering. In this scenario, receptors are assumed to inhale VOCs while showering and during time spent in the bathroom after showering. The shower model described by Schaum et al., (1994), was used

to evaluate exposure to COPCs in groundwater for future industrial/commercial workers who may take a shower on site.

The shower model treats the bathroom as one compartment and yields an air concentration averaged over the time of the actual shower and the time spent in the bathroom after the shower. The model was derived by assuming that the chemical volatilizes at a constant rate, instantly mixes uniformly with the bathroom air, and that ventilation with clean air does not occur. This implies that the chemical concentration in the air increases linearly from zero to a maximum at the end of the shower, and then remains constant during the time an individual spends in the bathroom immediately after showering.

The equation used to estimate chemical intake by inhalation during showering is the same as for inhalation of soil above, except for the following:

$$CA = \frac{((CA_{max}/2) \times t_1) + (CA_{max} \times t_2)}{(t_1 + t_2)}$$

where:

$$CA_{max} = CW \times f \times Fw \times t_1 \times 1/Va$$

and where:

CW	=	chemical concentration in groundwater (µg/L)
CA	=	chemical concentration in air (µg/m^3)
f	=	fraction volatilized, chemical-specific
Fw	=	water flow rate (L/hr), assumed to be 1000 L/hr
t_1	=	time of shower (hr), assumed to be 20 minutes
Va	=	bathroom volume (m^3), assumed to be 12 m^3
t_2	=	time after shower in bathroom (hr), assumed to be 15 minutes

CA_{max} was calculated for each COPC, and then used to determine the concentration of the chemical in air (CA). Calculations for CA_{max} and CA are found in Appendix B, Tables B2.6 and B2.7, respectively.

Inhalation of VOCs by construction workers during trenching or excavation activities was evaluated following the approach offered by the Virginia Department of Environmental Quality's (VDEQ's) guidelines for situations where shallow contaminated groundwater may pool in an excavation. The VDEQ spreadsheet (VRP 37, Table 3-8, Groundwater: Construction Worker in a Trench, for groundwater < 15 ft from soil surface) was utilized to develop VOC concentrations in air. This table was obtained on-line at VDEQ's website:

http://www.deq.virginia.gov/Programs/LandProtectionRevitalization/RemediationPrograms/VoluntaryRemediationProgram/VRPRiskAssessmentGuidance/Guidance.aspx.

To evaluate volatiles collecting in a trench, the trench dimensions (as a default scenario) are assumed to be 8 feet long by 3 feet wide, to a depth of 8 feet. The concentrations of the volatile chemicals in groundwater that may collect in the trench, are shown on Table B2.8 in Appendix B.

The exposure concentration available in air for the industrial worker to inhale while showering is calculated by using the formula below:

$$EC = \frac{CA \times ET \times EF \times ED \times CF}{AT}$$

where:

EC = exposure concentration (µg/m^3)
CA = chemical concentration in air (µg/m^3)
ET = exposure time (hours/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
CF = conversion factor (1 day/24 hours)
AT = averaging time (period over which exposure is averaged, days)

Using CA, the assumed EC for an industrial worker showering with site groundwater was calculated, as shown on Table B2.9 in Appendix B.

Using the calculated assumed COPC concentration in air, the EC available for inhalation by the construction worker who may inhale volatiles in a trench, was calculated as shown on Table B2.10 in Appendix B.

Currently, the USEPA is re-evaluating the methodology to estimate risks via the vapor intrusion pathway. Inhalation of VOCs while indoors, via the vapor intrusion pathway, was evaluated for on-site industrial workers and off-site residents by using the OSWER Vapor Intrusion Assessment Groundwater Concentration to Indoor Air Concentration Calculator Version 3.2, using USEPA Nov. 2015 RSLs. Cancer risks and noncancer hazards are provided for commercial (industrial) workers scenario with the groundwater volatile COPC exposure point concentrations used as input. The calculator was utilized with default settings, as a conservative approach. Results are discussed and presented in Section 3.5 below.

3.4 Toxicity Assessment

The toxicity assessment identifies the toxicity values (i.e. slope factors and reference doses) for COPCs. These toxicity values are applied to the assumed doses (intakes) calculated in the exposure assessment, in order to evaluate carcinogenic risk and noncarcinogenic hazard. The Integrated Risk Information System (IRIS) (USEPA, accessed on-line) is the preferred source of toxicity values, as the Tier 1 option. If a toxicity value was not available through IRIS, USEPA's recommended hierarchy of toxicity databases was followed (per USEPA, 2003) which suggests

that the Tier 2 option should be the Provisional Peer Reviewed Toxicity Values (PPRTVs) developed by The Office of Research and Development(ORD)/National Center for Environmental Assessment (NCEA). If toxicity values are not available in the Tier 1 or 2 options, USEPA suggests that three Tier 3 sources may be consulted, comprised of the following sources:

- California Environmental Protection Agency (Cal EPA) toxicity values available at the Cal EPA internet website: http://www.oehha.ca.gov/risk/chemicalDB//index.asp.
- Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs) available online at: http://www.atsdr.cdc.gov/mrls.html on the ATSDR website.
- EPA Health Effects Assessment Summary Tables (HEAST), available on-line at: https://epa-heast.ornl.gov/.

3.4.1 Carcinogenicity Evaluation

Carcinogenic oral slope factors (SFs) are presented on Table 3-11, containing the following information for each COPC: weight of evidence, and for oral, inhalation, and dermal pathways, tumor site(s), unit risk values, and SFs. References are provided as necessary.

Presently, toxicological data do not exist from which dermal SFs can be derived. To evaluate the dermal pathway, USEPA has adopted methodology to obtain dermal SFs by adjusting the oral SFs. The equation for extrapolation of a default dermal SF is as follows:

Default Dermal SF = Oral SF / Oral Absorption Factor (%)

Dermal SFs are also presented on Table 3-11 and include the oral absorption factor (oral bioavailability) data properly referenced.

Inhalation cancer risks are calculated by use of the Inhalation Unit Risk (IUR) Factors; Table 3-12 provides a list of IURs utilized, along with the appropriate source referenced.

3.4.2 Noncarcinogenic Hazards Evaluation

Oral reference doses (RfDs) are derived from toxicological data and can be obtained from USEPA toxicological databases, such as IRIS. However, for the dermal pathway, oral RfDs are adjusted to derive dermal RfDs in an approach similar as that described above for the derivation of dermal SFs, and as follows:

Dermal RfD = Oral RfD x Oral Absorption Factor (%)

Noncarcinogenic oral RfDs are presented on Table 3-13, and for each COPC include the critical effect/target organ affected and are properly referenced. Table 3-13 also contain dermal RfDs, and includes the oral absorption factors for each COPC along with the proper reference.

Inhalation noncancer risks are calculated by use of the inhalation reference concentrations (RfCs); Table 3-14 provides a list of IURs utilized, along with the appropriate source referenced.

3.4.3 Mutagenic Evaluation

Some receptors are highly sensitive to chemicals that demonstrate a mutagenic mode of action. The most sensitive of such receptors are children and adolescents. Because the adolescent trespasser and off-site child resident receptor are evaluated in this risk assessment, an adjustment is required while calculating the excess lifetime cancer risks to account for the special case of mutagenicity.

Chemicals selected as COPCs for receptors below the age of 17 in this risk assessment that are evaluated as possessing mutagenic modes of action (per USEPA, 2005) include the following: chromium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, methylene chloride, tetrachloroethylene, and trichloroethylene.

To make the necessary adjustment for mutagenicity, an Age-Dependent Adjustment Factor (ADAF) is applied. The child under the age of two requires an ADAF of 10, and between the ages of 2 to < 16, requires and ADAF of 3 (USEPA, 2005). These calculations are shown on all risk characterization tables in Appendix B (discussed further below in Section 3.5), which present risk results for off-site child residents and adolescent trespassers.

3.5 Risk Characterization

The objective of the risk characterization step is to integrate the information developed in the exposure assessment and the toxicity assessment into an evaluation of the potential current and future health risks associated with the COPCs at the Site. Potential cancer risk was calculated by multiplying the estimated lifetime-averaged daily intake that is calculated for a chemical through an exposure route by the exposure route-specific cancer slope factor, as described below.

$$ELCR = DI \times SF$$

where:

ELCR	=	Excess Lifetime Cancer Risk (unitless)
DI	=	Daily intake of chemical (mg/kg-day)
SF	=	Cancer slope factor $(mg/kg\text{-}day)^{-1}$

To account for mutagenicity, the following formula is used for receptors below the age of 16, for chemicals denoted as having mutagenic properties:

$$ELCR = DI \times SF \times ADAF$$

where:

ADAF = Age-dependent adjustment factor (unitless)

Excess cancer risk for the inhalation pathway was estimated by utilizing the following formula (USEPA, 2009):

$$CR_{Inhalation} = IUR \times EC$$

where:

$ELCR_{Inhalation}$ = cancer risk via the inhalation pathway (unitless)
IUR = inhalation unit risk $[(\mu g/m^3)^{-1}]$
EC = exposure concentration $(\mu g/m^3)$

To account for mutagenicity, the following formula is used for receptors below the age of 16, for chemicals denoted as having mutagenic properties:

$$CR_{Inhalation} = IUR \times EC \times ADAF$$

Cancer risks by pathway and then pathway risks summed to obtain the cumulative cancer risk to a receptor from all chemicals and from all exposure routes.

The potential for noncarcinogenic health effects was evaluated by the calculation of hazard quotients (HQs) and hazard indices (HIs) (which are HQs summed). An HQ is the ratio of the exposure duration-averaged estimated daily intake through a given exposure route to the chemical and route-specific reference dose, calculated as presented below.

$$HQ = DI / RfD$$

where:

HQ = Hazard quotient (unitless)
DI = Daily chemical intake (mg/kg-day)
RfD = Noncancer reference dose (mg/kg-day)

The HQ for the inhalation pathway was calculated by using the following formula (USEPA, 2009):

$$HQ_{Inhalation} = EC / [\text{ Toxicity Value } \times 1000\ \mu g/m3\ ]$$

where:

HQ = hazard quotient via the inhalation pathway (unitless)

EC = exposure concentration ($\mu g/m^3$)
Toxicity Value = inhalation toxicity value (e.g. RfC)

HQs are summed to obtain HIs for each receptor scenario. Initially, HIs are calculated based on all chemicals and exposure routes. Following the calculation of cumulative noncancer risks, any receptors which exhibit an HI greater than 1.0 are further evaluated to determine if multiple organ affects are demonstrated. If so, chemicals are segregated by organ effect and cumulative noncancer risks (HIs) are obtained for the target organs and systems.

Risk Results for Surface Soil

Industrial workers, construction workers, and adolescent trespassers were evaluated for their potential exposure to surface soil of SMA 4. The calculated results for each chemical and pathway are presented on Tables B3.1, B3.2, and B3.3 for industrial workers, construction workers, and trespassers, respectively. Risk results for these receptors also are summarized on Table 3-15.

For industrial workers, the total excess lifetime cancer risk (ELCR) from exposure to chemicals in surface soil over all pathways was found to be 4.6E-05, which falls within EPA's acceptable risk range of 1E-06 to 1E-04. Individual chemicals that result in ELCRs greater than 1E-06 include: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, arsenic, and chromium. The noncancer HI result for the industrial worker is 0.08, far below the level of concern of 1.0. There are no individual chemicals with HQs greater than 0.1.

For construction workers, the total ELCR from exposure to chemicals in surface soil, summed over all pathways, was found to be 6.7E-07, which falls below EPA's acceptable risk range of 1E-06 and 1E-04. The noncancer HI result for the construction worker is 0.03, far below the level of concern of 1.0. There are no individual chemicals with HQs greater than 0.1.

For adolescent trespassers, the total ELCR from exposure to chemicals in surface soil, summed over all pathways, was found to be 5.6E-06, which falls within EPA's acceptable risk range of 1E-06 and 1E-04. Only one individual chemical resulted in an ELCR greater than1E-06, benzo(a)pyrene. The noncancer HI result for the trespasser is 0.01, which is far below the level of concern of 1.0. As such, there are no individual chemical HQ results found to be greater than 0.1 for this receptor.

Risk Results for Subsurface Soil

Industrial workers and construction workers were evaluated for their exposure to subsurface soil of SMA 4. The calculated results for each chemical and pathway are presented on Tables B3.4 and B3.5 for industrial workers and construction workers, respectively. Risk results for these receptors also are summarized on Table 3-16.

For industrial workers, the total excess lifetime cancer risk (ELCR) from exposure to chemicals in subsurface soil over all pathways was found to be 9.5E-07, which is a level of risk far below EPA's acceptable risk range of 1E-06 to 1E-04; thus, EPA considers this risk level acceptable. The noncancer HI result for the industrial worker is 0.01, far below the level of concern of 1.0.

For construction workers, the total ELCR from exposure to chemicals in subsurface soil, summed over all pathways, was found to be 4.2E-06, which falls within EPA's acceptable risk range of 1E-06 and 1E-04. Only one Individual chemical has an ELCR greater than 1E-06, benzo(a)pyrene. The noncancer HI result for the construction worker is 0.8, which is below the level of concern of 1.0. The individual chemical HQs found to be greater than 0.1 are benzene, chlorobenzene, and toluene.

Risk Results for the Mineral Wool

Industrial workers and off-site residents were evaluated for their theoretically potential exposure to the Mineral Wool Pile. The calculated assumed results for each chemical and pathway are presented on Tables B3.6, B3.7, and B3.8 for industrial workers, adult off-site residents, and child off-site residents, respectively. All risk results for this media are summarized on Table 3-17.

For industrial workers, total ELCR from exposure to chemicals in mineral wool over all pathways was found to be 1.1E-06, which falls within EPA's acceptable risk range of 1E-06 to 1E-04. No individual chemical ELCRs are greater than 1E-06. The noncancer HI result is 0.002, far below the level of concern of 1.0.

For adult residents, ELCR from the assumed potential exposure to chemicals in mineral wool via inhalation was found to be 1.9E-07. For child residents, ELCR was found to be 2.3E-07. This risk result takes into account the added effects from exposure to mutagenic chemicals. These levels of risk far below EPA's acceptable risk range of 1E-06 to 1E-04; thus, EPA considers these risk levels acceptable. The noncancer HI result for adults is 8.6E-05 and for children is 1.7E-04, both of which far below the level of concern of 1.0.

Risk Results for Groundwater

Future industrial workers were evaluated for exposure to on-site groundwater via ingestion, dermal contact while showering, inhalation of volatiles while showering, and inhalation of volatiles via vapor intrusion into a building. Current and future construction workers were evaluated for exposure to groundwater via dermal contact if groundwater is encountered during trenching and inhalation of volatiles that may collect in a trench. Table B3-9 presents the risk calculation results for industrial workers, for all pathways except vapor intrusion, which is discussed separately below. Table B3-10 presents the risk calculation results for construction workers. Risk results for these workers are also summarized in Table 3-18.

For future industrial workers, the ELCR from exposure to chemicals in groundwater, summed over all pathways, was found to be 1.3E-02, which exceeds EPA's acceptable risk range of 1E-06 to

1E-04. Multiple individual chemicals have ELCR results that exceed 1E-06, including: vinyl chloride, benzene, 1,2-dichloroethane, 1,4-dioxane, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, pentachlorophenol, naphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. The noncancer HI result for the future industrial worker is 330, which also exceeds the level of concern of 1.0. Multiple chemicals contribute to this HI, those with individual HQs exceeding 0.1 include: vinyl chloride, methylene chloride, cis-1,2-dichloroethene benzene, 1,2-dichloroethane, trichloroethene, toluene, chlorobenzene, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, pentachlorophenol, and naphthalene.

Because the HI exceeds 1.0 for future industrial workers exposed to groundwater, further evaluation is warranted. HQs are segregated by target organ and system, and then summed to show the resulting HIs. HQs for the future industrial workers are segregated by target organ and system on Table 3-19. Results show that an HI of 1.0 is exceeded for chemicals affecting the liver (HI of 180), the kidneys (HI of 180), lymphocytes (HI of 140), the central nervous system (HI of 3.2), the immune system (HI of 140), and the endocrine system (HI of 2.8). HI results less than 1.0, but greater than 0.1, are shown for the thymus, the nasal system, and body weight.

For construction workers, the total ELCR from exposure to chemicals in groundwater, summed over all pathways, was found to be 5.6E-04, which exceeds EPA's acceptable risk range of 1E-06 and 1E-04. Multiple individual chemicals have ELCRs greater than 1E-06 including: vinyl chloride, benzene, 1,2-dichloroethane, and 1,4-dichlorobenzene. The noncancer HI result for the construction worker is 370, which exceeds the level of concern of 1.0. The individual chemical HQs found to be greater than 0.1 are: vinyl chloride, benzene, 1,2-dichloroethane, trichloroethene, toluene, chlorobenzene, 1,2,4-trichlorobenzene, and naphthalene.

Because the HI exceeds 1.0 for construction workers exposed to groundwater, further evaluation is warranted. HQs are segregated by target organ and system, and then summed to show the resulting HIs. HQs for the construction workers are segregated by target organ and system on Table 3-19. Results show that an HI of 1.0 is exceeded for chemicals affecting the liver (HI of 200), the kidneys (HI of 210), lymphocytes (HI of 160), the immune system (HI of 160), and the endocrine system (HI of 2.8). HI results less than 1.0, but greater than 0.1, are shown for the central nervous system, the thymus, the nasal system, and body weight.

To evaluate vapor intrusion risk to industrial workers, groundwater vapor intrusion COPC exposure point concentrations are input into the USEPA's VISL calculator to derive the associated cancer risk and noncancer hazard. The receptor scenario was set in the calculator as the "commercial worker". All program default parameters were utilized for this effort. Vapor Intrusion risk results, as produced by the VISL calculator, are shown on Table B3.11 for on-site industrial workers. These results are summarized on Table 3.20.

The VISL vapor intrusion ELCR for the industrial worker is 2.7E-03, which exceeds the EPA's acceptable risk range of 1E-06 to 1E-04. Individual chemicals with ELCRs greater than 1E-06 for the industrial worker include: vinyl chloride, benzene, 1,2-dichloroethane, and 1,4-dichlorobenzene. The vapor intrusion HI for the industrial worker is 292. Individual chemical with HQs greater than 0.1 for the industrial worker include: vinyl chloride, benzene, 1,2-dichloroethane, toluene, chlorobenzene, and 1,2,4-trichlorobenzene. The major contributors to excess risk for the industrial worker from vapor intrusion is benzene (HQ of 31) and chlorobenzene (HQ of 260).

Site-Wide Cumulative Risks

Risk results for each receptor were summed across all environmental media to derive the cumulative site-wide risk. The cumulative risks for each receptor are presented on Table 3-21. Cumulative ELCRs exceed 1E-04 for the following receptors: current and future industrial workers and current and future construction workers. For both of these receptors, the primary media of concern is groundwater. For noncancer effects, the HIs exceed 1.0 for the same receptors, and again, the primary media of concern is groundwater.

The site-wide cumulative risks for all other receptors, or potential receptors, is acceptable.

Sites with cumulative risk results in exceedance of 1E-04 for cancer effects, and HIs greater than 1.0 for noncancer hazards, are evaluated further to determine if remediation may be warranted. For SMA 4 receptors demonstrating cumulative site risks greater than 1E-04, Preliminary Clean-up Standards (PCSs) were calculated for soil and groundwater for any chemical which demonstrated an individual ELCR exceeding 1E-06 and an individual HQ of 0.1. Methodology used to calculate PCSs and the PCS results are presented in Section 3.7 below.

3.6 Uncertainty Analysis

There are a number of factors that contribute uncertainty to the estimates of exposure and risk presented above, which may result in an underestimation or overestimation of risk. Some of these factors are presented below.

Uncertainties Related to the Selection of COPCs

One area of uncertainty that leads to a likely overestimation of risk is retaining chemicals as COPCs that are demonstrated as having very low frequencies of detection. USEPA's RAGs Part A guidance (1989) suggests that chemicals infrequently detected may be eliminated as COPCs, as they are not likely to present a health threat at the level which merits quantification. In this HHRA, no chemicals were eliminated from selection as COPCs because of low frequency of detection (to comport with USEPA Region 4 guidance [2014]). However, for the on-site groundwater chemicals listed below, they have been detected at a rate of less than 5% and have risk results showing individual ELCRs greater than 1E-06 and/or HQs greater than 0.1:

- 1,2-Dichloroethane – detected in 1 out of 67 samples
- Trichloroethene – detected in 3 out of 67 samples
- Pentachlorophenol – detected in 1 out of 43 samples

Risk results for these three compounds in groundwater are likely to be overestimated.

Uncertainties Related to Exposure Parameters

When evaluating exposure, probable scenarios are developed to estimate conditions and durations of human contact with a COPC. Scenarios are based on observations or assumptions about the current or potential activities of human populations that could result in exposure. To prevent underestimations of risk, scenarios incorporate exposure levels, frequencies, and durations at or near the top end of the range of probable values. This reasonable maximum exposure (RME) approach is one that may be at the high end of the range of possible exposures, resulting in very protective assumptions.

Default values, such as ingestion rates, are used in the exposure calculations to quantify intakes. Although these values are based on USEPA-validated data, there is uncertainty in the applicability of such values to any particular exposed population or individual. To compensate for this uncertainty, the default values are typically set to the upper end (usually the 90th or 95th percentile) of the normal range, resulting in very protective assumptions.

Uncertainty Related to Toxicological Values

Uncertainties based upon derivation and use of toxicological values are inherent in each risk characterization. Some of these include:

- The use of animal data to predict potential human health effects.
- Extrapolation of experimental data obtained by exposing animals to high chemical doses to the likely outcome in humans following exposure to low chemical levels in the environment.
- The use of conservatively derived toxicological criteria.
- The lack of toxicity data for some chemicals evaluated in the risk characterization.
- Lack of toxicity criteria specific for evaluating the dermal route of exposure.

Uncertainties Related to Exposure Pathways Evaluated

Additional areas of uncertainty are in regard to the site-specific exposure pathways selected for quantification. For example, groundwater was evaluated at SMA 4 as a potable source for the future industrial worker. Presently, groundwater is prohibited from being used for such purposes. There is no evidence pointing to a change in the future, at least not for this area. Therefore, evaluating risks to industrial workers who drink and shower with on-site groundwater is likely to be an overly conservative approach, resulting in an overestimation of risk for the future industrial worker.

A second example regarding quantification of exposure pathways is evaluating adolescent trespassers for potential contact with constituents in site surface soil. As a conservative approach, this receptor was evaluated, but it is more likely that this pathway is incomplete. ERP Coke is an extremely secure facility, and the likelihood of a young person entering the site, with the conservative exposure frequencies and durations used in this risk assessment, is low. Hence, even though the risk results demonstrated in this HHRA were not found at unacceptable levels, they are still likely to be overestimated.

Another example regarding quantification of exposure pathways is evaluating exposures to mineral wool. In the absence of an available alternative approach, the intake of mineral wool by receptors was calculated as if the material were soil. The same equations recommended by USEPA to evaluate soil intake were used to calculate mineral wool intake, when it is more likely that less intake would be realized. The nature of the Mineral Wool Pile is such that as it sits exposed to weathering processes, the surface develops a crusty nature, has a vegetative cover which will limit its uptake via ingestion, dermal absorption, and inhalation. However, as a means of evaluating this material, it was treated as if it were soil and intake and risk were calculated for on-site industrial workers and off-site residents. This is a very conservative approach, and although the risk results for these receptors were not found to be an unacceptable levels, it is likely that they are overestimated.

3.7 Preliminary Cleanup Standards

On a media-by-media basis, preliminary cleanup standards (PCSs) were calculated for every individual chemical resulting in an ELCR greater than 1E-06 or an HQ greater than 0.1 for a receptor demonstrating a site-side cumulative ELCR greater than 1E-04 or a site-wide cumulative HI greater than 1.0. These chemicals are also known as chemicals of concern (COCs), or risk drivers, as they are the chemicals which would be moved forward to the Corrective Measures Study phase to evaluate alternatives for clean-up to ensure protectiveness. In order to evaluate clean-up strategies, a clean-up level must first be established, hence the need to calculate PCSs for the SMA 4 COCs.

Surface Soil PCSs

PCS calculations showing contributions from ingestion, dermal absorption, and inhalation are presented for the industrial worker exposed to surface soil in Tables B4.1, B4.2, and B4.3, respectively. Surface soil PCSs for carcinogenic effects for industrial workers, derived by the summation of all pathway contributions are presented on Table B4.4. Surface soil PCSs for noncarcinogenic effects for industrial workers, derived by the summation of all pathway contributions are presented on Table B4.5. Both the carcinogenic and noncarcinogenic PCSs for surface soil are summarized on Table 3-22.

Subsurface Soil PCSs

PCS calculations showing contributions from ingestion, dermal absorption, and inhalation are presented for the construction worker exposed to subsurface soil in Tables B4.6, B4.7, and B4.8, respectively. Surface soil PCSs for carcinogenic effects for construction workers, derived by the summation of all pathway contributions are presented on Table B4.9. Surface soil PCSs for noncarcinogenic effects for construction workers, derived by the summation of all pathway contributions are presented on Table B4.10. Both the carcinogenic and noncarcinogenic PCSs for subsurface soil are summarized for construction workers on Table 3-23.

Groundwater PCSs

Groundwater PCSs for potential future industrial workers and construction workers were calculated by using the ratio of a chemical's EPC to the resulting carcinogenic ELCR and noncancer HQ for each COC. This method was employed because of the complexity of the showering pathway for industrial worker and the inhalation of VOCs in a trench by the construction worker. Both the carcinogenic and noncarcinogenic PCSs for groundwater are summarized for industrial workers and construction workers on Table 3-24.

4.0 IDENTIFICATION AND DEVELOPMENT OF PRELIMINARY CLEANUP STANDARDS AND GENERAL RESPONSE ACTIONS

This CMS Report presents the results of the step-by-step evaluation of corrective measure alternatives at SMA 4 under the 2012 AOC. This report reflects the typical CMS format, with Sections 4.0 through 8.0 organized to match the four steps of the CMS process.

This section presents Step 1 of the CMS Process – Development of Preliminary Cleanup Standards (PCSs), Corrective Action Objectives, and General Response Actions. Corrective Action Objectives (CAOs) are medium-specific goals for protecting human health and the environment. Attainment of these goals, which specify the contaminants of concern (COCs), the exposure route(s), and acceptable contaminant levels for each receptor, will result in residual concentrations that are within acceptable levels of risk to human health and the environment. Therefore, the purpose of Step 1, as summarized in this section, is to establish PCSs such that CAOs can be developed and general response actions can be identified for the protection of site receptors from potentially contaminated media at SMA 4.

4.1 Preliminary Cleanup Standards (PCSs) From Human Health Risk Assessment

Medium-specific, as well as chemical-specific PCSs were calculated during the risk assessments developed in Section 3.0 as required by the 2012 AOC. For this CMS, acceptable exposure levels for the contaminants of concern calculated in the risk assessment for SMA 4 (Section 2.0) were used to develop PCSs. The media cleanup goals provide current and long-term considerations to use during analysis and selection of corrective action alternatives (CAAs).

The risk assessment results calculated in Section 3.0 were prepared to calculate cumulative total risk. The cumulative industrial/commercial risk and construction worker risk exceeded an excess lifetime cancer risk (ELCR) 1E-04 and a hazard index (HI) of 1.0. Therefore, for constituents of concern (COCs) that exceeded an ELCR of 1E-06 or a HI of 1.0, Preliminary Cleanup Standards (PCSs) were calculated. The PCSs were calculated to levels that would achieve a target risk levels of 10-4, 10-5, and 10-6 and target Hazard Indexes of 3, 1, and 0.1 for each COC and are presented in the following sections.

As discussed in the OSWER Directive 9355.0-30 dated April 22, 1991, acceptable risk levels for calculated cumulative carcinogenic risks to an individual based on exposure assumptions can range from 10-4 to 10-6 as long as the cumulative excess lifetime carcinogen site risk is less than 10^{-4} and the noncancer hazard index (HI) is less than 1. In order to meet the goal of the cumulative ELCR less than 10-4 and a HI of 1.0 across all media, the analytical samples from each sample media were screened against the calculated PCSs for the ELCR of 10-5 or a HI of 0.1. If multiple

receptors exceeded the ELCR of 10-4 and HI of 1.0 for a specific media, then the most conservative PCS value for the 10^{-5} ELCR or 0.1 HI was used to screen the data.

Section 3.0 above determined that risks for all potential receptors other than the industrial and construction worker scenarios fell within EPA's acceptable range; therefore, PCSs were calculated for only the industrial/commercial worker scenario and the construction worker scenario for all completed pathways as appropriate.

4.1.1 Surface Soil PCSs

Surface soil samples were collected from AOC B of SMA 4 during preparation of this CMS and are shown on Figure 2-1. The surface soil samples were collected between 0 - 1 foot below ground surface (bgs) interval in AOC B. These samples were used to calculate the surface soil risk to the receptors. A summary of the analytical data for the surface soil collected in AOC B is included as Table A-1 (Appendix A). The surface soil risk summary based on the exposure assumptions for industrial/commercial workers and construction workers is included as Table 3-15. The COCs are any constituent with an ELCR greater 1E-06 or an HQ of 0.1. These constituents are summarized below in Table 4-1.

Table 4-1
Risks Summary – Industrial/Commercial Worker,
Assumed Exposure to Surface Soil (0 to 1 foot)
Major Contributors to Total Risk† - Summed Over All Exposure Pathways

Chemical	ELCR	HQ
Benzo(a)anthracene	**1.6E-06**	na
Benzo(a)pyrene	**1.7E-05**	na
Benzo(b)fluoranthene	**2.9E-06**	na
Dibenz(a,h)anthracene	**5.1E-06**	na
Indeno(1,2,3-cd)pyrene	**1.4E-06**	na
Arsenic	**1.0E-05**	6.4E-02
Chromium	**7.8E-06**	1.4E-02

ELCR = Excess Lifetime Cancer Risk
HQ = Hazard Quotient
†Chemicals exhibiting ELCRs greater than 1E-06 and HQs greater than 0.1.
na = not applicable; toxicity factors are not available for these chemicals
EPC = exposure point concentration, the 95%UCL value, mg/kg

PCSs were calculated for the constituents that exceeded an ELCR of 10-6 or an HQ of 0.1. The PCSs were calculated for a target risk level of 10-4, 10-5, and 10-6 and a target hazard index of 3, 1, and 0.1. The PCSs are shown in Table 4-2 below. In order to meet a cumulative risk level of less than an ELCR of 10-4 or a HI of 1.0, the PCS chosen to act as a cleanup trigger level on a domain averaging basis is the most conservative calculated value between the ELCR of 10-5 or a HQ of 0.1. The PCSs for the surface soils are highlighted in green.

Table 4-2
Preliminary Cleanup Standards (PCSs) Summary for Surface Soils
(Units in mg/kg)

Chemical of Concern		Target Risk Level				Target Hazard Index		
		1.0E-04	1.0E-05	1.0E-06		3	1	0.1
Industrial/Commercial Workers								
Benzo(a)anthracene		290	29	2.9				
Benzo(a)pyrene		29	2.9	0.3				
Benzo(b)fluoranthene		290	29	2.9				
Dibenz(a,h)anthracene		29	2.9	0.3				
Indeno (1,2,3-cd)pyrene		291	29	2.9				
Aresnic		194	19	1.9				
Chromium		649	65	6.5				

4.1.2 Subsurface Soil PCSs

Subsurface soil samples collected from SMA 4 during previous investigations are shown on Figure 2-2. The subsurface soil samples included the soil samples collected between 2-15 feet bgs in SMA 4. These samples were used to calculate the subsurface soil risk to the receptors. A summary of the analytical data for the soil collected in SMA 4 is included as Table A-2 (Appendix A). The subsurface soil risk summary based on the exposure assumptions for industrial/commercial worker and construction worker is included as Table 3-16, and they are summarized below in Table 4-3.

Table 4-3
Risks Summary - Construction Workers,
Assumed Exposure to Subsurface Soil (2 to 15 feet)
Major Contributors to Total Risk† - Summed Over All Exposure Pathways

Chemical	ELCR	HQ
Benzene	6.0E-07	**1.8E-01**
Chlorobenzene	na	**1.6E-01**
Toluene	na	**1.2E-01**
Benzo(a)pyrene	**1.6E-06**	na

ELCR = Excess Lifetime Cancer Risk
HQ = Hazard Quotient
†Chemicals exhibiting ELCRs greater than 1E-06 and HQs greater than 1.0.
na = not applicable; toxicity factors are not available for these chemicals
EPC = exposure point concentration, the 95%UCL value, mg/kg

Although the ELCR associated with subsurface soils fell within EPA's acceptable range, PCSs were calculated for the constituents that exceeded an ELCR of 10-6 or an HQ of 0.1. The PCSs were calculated for a target risk level of 10-4, 10-5, and 10-6 and a target hazard index of 3, 1, and 0.1. The PCSs are shown in Table 4-4 below. Since the cumulative HI was less than 1.0, the target HI of 1.0 was used as a cleanup trigger. The PCS chosen to act as a cleanup trigger level on a domain averaging basis is the most conservative calculated value between the ELCR of 10-5 or a HQ of 1.0. The PCSs for the subsurface soils are highlighted in green.

Table 4-4
Preliminary Cleanup Standards (PCSs) Summary for Subsurface Soils
(Units in mg/kg)

		Target Risk Level				Target Hazard Index		
Chemical of Concern		**1.0E-04**	**1.0E-05**	**1.0E-06**		**3**	**1**	**0.1**
Construction Workers								
Benzo(a)pyrene		281	28	2.8				
Benzene						1226	409	41
Chlorobenzene						3514	1171	117
Toluene						65355	21785	2179

4.1.3 Mineral Wool Piles PCSs

Samples collected from the SWMU 35 - Mineral Wool Piles in SMA 4 during previous investigations are shown on Figure 2-2. These samples were used to calculate the assumed risk to industrial workers. A summary of the analytical data for the soil collected in SWMU 35 is included as Table A-3 (Appendix A). The Mineral Wool Piles risk summary is included as Table 3-17. None of the COCs had and ELCR greater than 1E-06 or a HQ greater than 0.1. Therefore PCSs were not calculated for the mineral wool.

4.1.4 Groundwater PCSs

Groundwater samples were collected during previous investigations in SMA 4 (Figure 2-2). A summary of the analytical data for the groundwater collected in SMA 4 is included in Table A-4 (Appendix A). The groundwater risk summary based on the exposure assumptions for industrial/commercial worker and construction worker is included as Table 3-16, and they are summarized below in Table 4-5.

Table 4-5
Risks Summary - Industrial/Commercial Workers and Construction Workers
Assumed Exposure to Groundwater
Risk Summed Over All Exposure Pathways, at each Well
For Chemicals Detected in the Specified Well

	Industrial/Commercial Worker		Construction Worker	
Chemical	**ELCR**	**HQ**	**ELCR**	**HQ**
Vinyl chloride	**2.1E-04**	**3.8E-01**	**1.7E-06**	**2.5E-01**
Methylene chloride	6.1E-07	**1.6E-01**	3.4E-09	3.9E-02
cis-1,2-Dichloroethene	na	**2.7E-01**	na	8.9E-03
Benzene	**1.2E-02**	**1.4E+02**	**5.5E-04**	**1.6E+02**
1,2-Dichloroethane	**1.4E-04**	**1.9E+00**	**6.4E-06**	**2.4E+00**
Trichloroethene	5.1E-07	**1.3E-01**	1.5E-08	**1.3E-01**
Toluene	na	**2.7E+00**	na	**8.7E-01**
Chlorobenzene	na	**1.7E+02**	na	**2.0E+02**
1,4-Dioxane	**1.1E-06**	1.1E-02	2.5E-09	1.2E-03
1,2,4-Trichlorobenzene	**8.4E-06**	**2.8E+00**	2.8E-08	**2.8E+00**
1,4-Dichlorobenzene	**1.6E-04**	**1.0E-01**	**7.0E-06**	6.0E-02
Pentachlorophenol	**4.1E-04**	**5.7E-01**	4.5E-07	1.6E-02
Naphthalene	**1.5E-05**	**4.2E-01**	7.0E-07	**4.8E-01**
Benzo(a)anthracene	**1.1E-05**	na	1.5E-08	na
Benzo[a]pyrene	**8.6E-05**	na	1.0E-07	na
Benzo(b)fluoranthene	**6.6E-06**	na	8.0E-09	na
Dibenz(a,h)anthracene	**6.3E-05**	na	6.3E-08	na
Indeno[1,2,3-cd]pyrene	**1.6E-05**	na	1.6E-08	na

ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index

PCSs were calculated for the constituents that exceeded an ELCR of 10-6 or an HQ of 0.1. The PCSs calculated from the groundwater samples are shown below in Table 4-6. In order to meet a cumulative risk level of less than an ELCR of 10-4 or a HI of 1.0. The PCS chosen to act as a cleanup trigger on a domain averaging basis is the most conservative calculated value between the ELCR of 10-5 or a HQ of 0.1. The PCSs for the groundwater samples are highlighted in green.

Table 4-6
Preliminary Cleanup Standards (PCSs) Summary for SMA 4 Groundwater
(Units in µg/l)

Chemical of Concern	Target Risk Level			Target Hazard Index		
	1.0E-04	1.0E-05	1.0E-06	3	1	0.1
Industrial/Commercial Worker						
Benzene	149	15	1.5	385	128	12
Chlorobenzene				784	261	26
Toluene				15,835	5,278	527
Trichloroethene				28.6	9.54	0.95
Vinyl chloride	37	3.7	0.37	624	208	21
1,2,4-Trichlorobenzene	390	39	3.9	36	12	1.2
1,2-Dichloroethane	54	5.4	0.54	117	39	3.9
Cis-1,2-Dichloroethene				607	202	20.2
1,4-Dichlorobenzene	146	15	1.5			
1,4-Dioxane	170	17	1.7			
Benzo(a)anthracene	0.8	0.08	0.008			
Benzo[a]pyrene	0.05	0.005	0.0005			
Benzo(b)fluoranthene	0.9	0.09	0.009			
Dibenz(a,h)anthracene	0.03	0.003	0.0003			
Indeno[1,2,3-cd]pyrene	0.3	0.003	0.0003			
Methylene chloride				1,641	547	54.7
Naphthalene	51.8	5.18	0.518	54.4	18.1	1.81
Pentachlorophenol	5.1	0.51	0.051	110	36.8	3.7
Construction Worker						
Benzene	3,273	327	33	337	110	11
Chlorobenzene				666	222	22
Trichloroethene				28.6	9.54	0.95
Vinyl chloride	4,660	466	46.6	950	317	31.7
1,2-Dichloroethane	1,172	117	11.7	93.7	31.2	3.12
1,4-Dichlorobenzene	3,274	327	32.7			
1,2,4-Trichlorobenzene				35	12	1.2
Naphthalene				47	16	1.6
Toluene				49,145	16,382	1,638

Groundwater risk for vapor intrusion was also calculated for industrial/commercial workers. The vapor intrusion screening indicates a risk in excess of an ELCR of 10E-04 and a HI of 1.0. However, calculation of PCSs for vapor intrusion is unnecessary because this theoretical risk will be adequately mitigated if the groundwater PCSs set forth in Section 4-7 are achieved. Therefore, additional consideration of onsite vapor intrusion studies is not warranted.

4.1.5 Summary of PCSs

Table 4-7 and 4-8 below lists the summary of the PCSs highlighted in green from the surface soil PCSs from Table 4-3, the subsurface soil from Table 4-5, and the Groundwater PCSs from Table 4-8.

Table 4-7
Preliminary Cleanup Standards (PCSs) Summary
Surface Soil and Subsurface Soil

	Surface Soil		Subsurface Soil	
	ECLR (mg/kg)	HQ (mg/kg)	ECLR (mg/kg)	HQ (mg/kg)
Chemical of Concern	**1.0E-05**	**0.1**	**1.0E-05**	**0.1**
Benzo(a)anthracene	29			
Benzo(a)pyrene	2.9		28	
Benzene				41
Chlorobenzene				117
Toluene				2179
Benzo(b)fluoranthene	29			
Dibenz(a,h)anthracene	2.9			
Indeno (1,2,3-cd)pyrene	29			
Arsenic	19			
Chromium	65			

The current USEPA MCLs and Tapwater RSLs (if MCL not available) are also included in table 4-9 below. The MCLs are the concentrations required to meet the groundwater restoration goal if the surficial aquifer at the site was determined to be a drinking water source. The MCLs/RSLs that are lower than the calculated PCSs are benzene, benzo(a)anthracene, and indeno(1,2,3)cd-pyrene.

Table 4-8
Preliminary Cleanup Standards (PCSs) Summary
Groundwater

	Groundwater		
	ECLR (ug/L)	HI (ug/L)	MCL/Tapwater RSL (ug/L)
Chemical of Concern	**1.0E-05**	**0.1**	
Benzene		11	5
Chlorobenzene		22	100
Toluene		527	1000
Trichloroethene		0.95	5
Vinyl chloride	3.7		2
1,2,4-Trichlorobenzene		1.2	70
1,2-Dichloroethane	5.4		5
Cis-1,2-Dichloroethene		20.2	70

	Groundwater		
	ECLR (ug/L)	HI (ug/L)	MCL/Tapwater RSL (ug/L)
Chemical of Concern	**1.0E-05**	**0.1**	
1,4-Dichlorobenzene	15		75
1,4-Dioxane	17		0.46
Benzo(a)anthracene	0.08		0.012
Benzo[a]pyrene	0.005		0.2
Benzo(b)fluoranthene	0.09		0.034
Dibenz(a,h)anthracene	0.003		0.0034
Indeno[1,2,3-cd]pyrene	0.03		0.034
Methylene chloride		54.7	5.0
Naphthalene	5.18		0.17
Pentachlorophenol	0.51		1.0

4.2 Estimated Areas of Affected Media

Based on the results of the previous investigations and the cleanup goals established in the HRRA risk assessment, approximate areas of affected media at SMA 4 were identified. Areas were calculated based on assumptions as required by the 2012 AOC to be above the PCS established in Section 4.1. However, not all of the estimated media will necessarily be the subject of corrective action because (1) some media do not present an unacceptable risk and (2) any corrective action will be to achieve the media-specific PCS on a domain averaging basis.

4.2.1 Surface Soil

The following PCS were exceeded in the surface soil samples:

- Benzo(a)pyrene – SBB001 and SBB002
- Arsenic – SBB002, SBB003, SBB008

The surface soil COCs above the PCS are presented in Table A-1 and on Figure 4-1.

The cumulative ELCR for SMA 4 was greater than 10-4, and an overall goal of corrective measures at SMA 4 will therefore be to move the cumulative ELCR to within EPA's acceptable risk range of 10-4 to 10-6. In light of that, we are of the opinion that the surface soil is not a threat to human health and the environment and is not in need of active remediation. We base this opinion on the following:

- Because of greater relative risks presented by other media, corrective measures on those other media alone are expected to lower the ELCR and HI to EPA's acceptable risk range.
- There is very limited surface soil in SMA 4, and receptors are present in the area where surface soil is present only infrequently.

- The cumulative surface soil ELCR and the HI are in EPA's acceptable ranges.
- In addition, since the completion of the ELCR, EPA released a toxilogical review of benzo(a)pyrene (Bap). Their results indicate that BaP is 7.3 times less potent as an oral carcinogen than previously thought, and is half as potent as an inhalation carcinogen. Therefore, the calculated PCS in surface soil for BaP is extremely conservative.
- The arsenic concentrations at this industrial facility range from 6.7 parts per million (ppm) to 26 ppm. By comparison, the EPA has allowed cleanup values as high as 37.0 ppm in residential soils in the state[2].

4.2.2 Subsurface Soil

The following PCS were exceeded in the subsurface soil samples:

- Benzene – CM-SB0033
- Chlorobenzene – Not Exceeded
- Toluene –CM-SB0018
- Benzo(a)pyrene – CM-SB0028, CM-SB0050

The subsurface soil COCs above the PCS are presented in Table A-2 and on Figure 4-2. The cumulative ELCR was below 10-4, and the cumulative HI was less than 1.0.

The subsurface soil was screened against the groundwater protection soil screening levels (GWP SSLs). The GWP SSLs are used to evaluate chemical concentrations in subsurface soil as a means of determining if measured site soil concentrations present a potential threat for future contamination of groundwater. GWP SSLs used for screening of SMA 4 subsurface soil chemical concentrations were derived in the Phase III RCRA Facility Investigation Report (Arcadis & CH2MHill, 2009). If SSLs were not available in the Phase II report, SSLs provided on USEPA's RSL table (Nov. 2015) were used. Chemical screening against groundwater protection SSLs is presented on Table A-2. Of the chemicals with a FOD greater than 5%, the 95% UCL of the mean for the chemicals listed below were found to exceed their respective SSLs in SMA 4 subsurface soil.

- Benzene
- Chlorobenzene
- Toluene
- Vinyl chloride
- 1-Methylnaphthalene
- 3 & 4 Methylphenol
- 4-Methylphenol (p-cresol)

[2] *Pallas, Jeffery T., 2011, "Final Residential Soil Cleanup Values", USEPA Restoration and Underground Storage Tank Branch RCRA Division.*

- Benzo(a)anthracene
- Benzo(b)fluoranthene
- Carbazole
- Dibenzofuran
- Naphthalene
- Arsenic

At least one constituent exceeded the groundwater protection soil screening levels (GWP SSL) in each of the following soil samples:

- CM-SB0003 through CM-SB0013;
- CM-SB0015 through CM-SB0027;
- CM-SB0029 through CM-SB0037;
- CM-SB0039;
- CM-SB0040;
- CM-SB0044;
- CM-SB0045;
- CM-SB0047;
- CM-SB0050 through CM-SB0052;
- CM-SB0054;
- CM-SB0055;
- CM-SB0058 through CM-SB0061;
- CM-SB0063;
- 26-SB0001;
- 26-SB0002;
- 27-SB0001;
- 27-SB0002;
- 29-SB0001;
- 29-SB0002;
- 31-SB0001;
- 31-SB0002; and
- MW-53 through MW-55.

The subsurface soil sample locations which have COCs exceeding the GWP SSLs are highlighted on Figure 4-3.

The cumulative ELCR for SMA 4 was greater than 10-4, and an overall goal of corrective measures at SMA 4 will therefore be to move the cumulative ELCR to within EPA's acceptable risk range of 10-4 to 10-6. In light of that, we are of the opinion that the subsurface soil concentrations are not a threat to human health or environmental receptors and subsurface soil is not in need of active remediation. We base this opinion on the following:

- Because of greater relative risks presented by other media, corrective measures on those other media alone are expected to lower the ELCR and HI to EPA's acceptable risk range.
- The cumulative subsurface soil ELCR and the HI are in EPA's acceptable ranges.
- In addition, since the completion of the ELCR, EPA released a toxilogical review of benzo(a)pyrene (Bap). Their results indicate that BaP is 7.3 times less potent as an oral carcinogen than previously thought, and is half as potent as an inhalation carcinogen. Therefore, the calculated PCS in subsurface soil for BaP is extremely conservative.
- The arsenic concentrations range from 1.5 parts per million (ppm) to 18 ppm in the subsurface soil. The EPA has allowed cleanup values as high as 37.0 ppm in residential soils in the state.

4.2.3 Mineral Wool Piles

Based on the results of the HHRA, no constituents exceeded an ELCR of 10E-6 or an HQ of 0.1; therefore, PCSs were not calculated. The Mineral Wool Piles do not require or warrant further action and are not affected media. The mineral wool is an end product. ERP Coke will continue to market it as such.

4.2.4 Groundwater

For the chemicals listed below, the PCS was exceeded in the following wells at least once in the last 6 sampling events:

- Benzene – MW-49S, MW-51, MW-54, MW-56, MW-56, MW-81
- Chlorobenzene – MW-54, MW-55, MW-56
- Toluene – MW-49S, MW-54, MW-55, MW-81, MW-89
- Trichloroethene – MW-49S, MW-51, MW-54, MW-55, MW-56, MW-81
- Vinyl Chloride – MW-49S, MW-50, MW-51, MW-52, MW-53
- Cis-1,2-Dichloroethene – MW-49S, MW-51, MW-52, MW-90
- Benzo(a)anthracene – MW-54, MW-56, MW-71
- Benzo(a)pyrene – MW-54, MW-56
- Benzo(b)fluoranthene – MW-54, MW-56, MW-71
- Dibenz(a,h)anthracene – MW-56, MW-71
- Indeno[1,2,3-cd]pyrene – MW-56, MW-71
- Methylene chloride – MW-70, MW-71
- Naphthalene – MW-56, MW-55, MW-56, MW-72, MW-81

The groundwater COCs above the PCS are presented in Table A-4 and on Figure 4-4, and the groundwater COCs above the MCLs are shown on Figure 4-5. The groundwater plume is approximately 550 ft x 800 ft.

4.3 Corrective Action Objectives

The corrective action objectives (CAOs) are medium-specific goals and specify the COCs, the exposure route(s) and receptor(s), and an acceptable contaminant level (i.e., remediation goal). The overall CAOs for SMA 4 are:

- Protect human health and the environment.
- Achieve the chemical-specific PCSs for each media, including restoration of groundwater to drinking water standards, if practicable, or other applicable standards.
    - Selection of cleanup standards also requires the establishment of points of compliance which represents where the media clean up levels are to be achieved; remediation time frame which is the site-specific schedule for a remedy) including both time frame to construct the remedy and estimate of the time frame to achieve the cleanup levels at the point of compliance).
- Control the source(s) of release so as to reduce or eliminate, to the extent practicable, further releases of hazardous waste or hazardous constituents that may pose a threat to human health and the environment.
- Comply with any applicable waste management standards.

4.3.1 Commercial/Industrial Worker

The cumulative risks across all media exceed an ELCR of 10E-04 and a HI of 1.0. The groundwater is the predominant factor in the exceedance of the cumulative risk.

4.3.2 Construction Worker

The cumulative risks across all media exceed an ELCR of 10E-04 and a HI of 1.0. The groundwater is the predominant factor in the exceedance of the cumulative risk. In addition, the HI in subsurface soil for a construction worker is 1.2 which is slightly greater than a HI of 1.0

4.4 General Response Actions

General response actions describe those actions that will satisfy the CAOs for all media. General response actions were considered for evaluation based on their adequacy to address affected media exceeding the PCSs. The response actions identified for this CMS are listed below and described in the subsequent sections.

- No Action
- Institutional Actions
- Containment
- Treatment
- Removal and Disposal

4.4.1 No Action

The No Action response establishes a baseline for alternative comparison. A no action alternative can include limited environmental monitoring to assess the impacts associated with no remedial actions, but cannot include actions to minimize risk by reducing either contaminant exposure pathways or contamination through treatment. The No Action response action proposed for this site would not include any environmental monitoring, remedial activity, or land use restrictions.

4.4.2 Institutional Controls

Institutional controls consist of land use controls including any type of physical, legal, or administrative mechanism that restricts use of or limits access to real property to prevent or reduce risks to human health and the environment. Physical mechanisms encompass a variety of remedies to contain or reduce contamination and may include physical barriers intended to limit access to property, such as fences or signs. Legal mechanisms include restrictive covenants, equitable servitudes, and deed notices. Administrative mechanisms include notices and construction permitting or land use management systems that may be used to ensure compliance with use restrictions. The legal mechanisms used for land use controls are generally imposed to ensure that restrictions on land use developed as part of an action remain in place.

4.4.3 Containment

The containment response action employs a barrier to limit the mobility of a constituent and/or prevent direct contact with the constituent.

4.4.4 Removal

Removal involves the excavation or extraction of affected media. The affected media will then be treated or disposed.

4.4.4.1 Treatment

Treatment of removed media involves the isolation of hazardous constituents from the media. Treatment will be evaluated as a means to reduce concentrations to acceptable levels or to create conditions that will limit or restrict constituent mobilization. The result is a reduction of the toxicity, mobility, or volume.

4.4.4.2 Disposal

Disposal of removed material involves the transport of media to an appropriate permitted off-site disposal facility. Disposal will be evaluated as a means to remove the hazardous material from the site for appropriate disposal.

5.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

This section describes the identification and screening of potentially applicable corrective action technologies and process options for each general response action described in Section 3.0 that may be applied to reduce and/or eliminate exposure to affected media at SMA 4. Screening potential technologies is an optional step and not required in the CMS process according to the Corrective Measures Study Scope of Work located at the website http://www.epa.gov/reg3wcmd/pdf/chev6.pdf referenced in Paragraph 29 of the AOC.

The identification of technologies for this CMS has been focused on realistic remedies that will achieve the corrective action objectives (see Section 3.3) for soil and groundwater at the site. USEPA presumptive remedies http://www.epa.gov/oerrpage/superfund/policy/remedy/presump/pol.htm was reviewed and used to streamline the identification process. Process options that represented the full spectrum of options for each technology were then identified so that a technology would not be eliminated during the screening process because of an overly narrow choice of process options.

The selection of corrective action technologies and process options to be considered for screening was based solely on technological limitations with respect to the unsuitability for the COCs identified in the media at SMA 4, the magnitude of COC concentrations, the characteristics of the materials, the distribution and location of the waste materials, and site-specific conditions such as topography and hydrogeologic characteristics (USEPA, 1994). The selected technologies and process options were then evaluated in terms of: effectiveness; reduction of toxicity, mobility, or volume of waste; implementability; and cost (with particular emphasis on effectiveness) using a *High*, *Medium*, and *Low* benefit rating system. A description of the screening criteria is presented below:

- Effectiveness – The effectiveness of a given process option was determined based on its ability to remediate the estimated volume of contaminated media and meet the cleanup levels listed in the CAOs. A *High* ranking indicates that the technology would be very effective.

- Reduction of toxicity, mobility, or volume of waste; implementability – The effectiveness of a given process option are based on the ability to destroy, remove, or degrade the existing contamination.

- Implementability – The ease or difficulty to implement the process option was evaluated in terms of the technical and administrative issues. A *High* ranking indicates that the technology would be easy to implement.

- Cost – A qualitative cost estimate of the process options was evaluated relative to the other process options under evaluation. The costs considered include capital costs and operation and maintenance costs. A *High* ranking indicates that the technology would be relatively inexpensive to implement when compared to the other technologies.

A description of each potentially applicable technology type and associated process options relative to soils, sediment, and groundwater are presented in the following subsections.

5.1 Surface and Subsurface Soil

5.1.1 No Action

The No Action response assumes that no additional source control measures will be implemented and no monitoring will be performed. As a result, no technologies or process options have been identified for the No Action response. No Action has been retained for further consideration as a corrective measures technology to serve as a basis of comparison.

5.1.2 Land Use Controls

The corrective measures technology identified for the institutional controls response is Land Use Controls. Land Use Controls consists of physical, legal, and administrative mechanisms to restrict the use of or limit access to affected areas of the site to protect current and future receptors.

Given that the proposed remedies for each of the SMAs rely on a LUCP, it is anticipated that EPA's final remedy proposal will require an Environmental Covenant pursuant to the Alabama Uniform Environmental Covenants Act, Code of Alabama 1975, §§35-19-1 to 35-19-14. Such covenants are necessary if the final remedy places a land use control at a facility because it is not being remediated to unrestricted use.

5.1.2.1 Physical Barriers

Physical barriers are mechanisms used to protect human health and the environment from exposure to the on-site sediments/soils, including fences and warning signs that would limit access to affected areas of the site. Fences could be erected around affected areas of the site and signs or permanent markers could be posted at the boundaries of affected areas of the site to warn current and future receptors of the remaining constituents and potential exposure. Each of these corrective action technologies is technologically feasible and has been retained for further consideration as a corrective measure alternative.

5.1.2.2 Legal Barriers

Legal barriers include restrictive covenants and deed notices. Each of these process options is technologically feasible and has been retained for further consideration as a corrective measures technology.

5.1.2.3 Administrative Barriers

Administrative barriers could include (1) a land use control plan (LUCP) to notify and restrict current receptors from accessing affected areas of the site and (2) development or use of construction permitting (e.g., digging permits) or restrictions to protect future receptors. These mechanisms have been retained for further consideration as corrective action technologies.

5.1.3 Treatment

Treatment technologies identified for subsurface soil remediation at this site are biological and physical processes.

5.1.3.1 Biological Treatment

Biological treatment technologies typically use naturally occurring bacteria to break down constituents into simpler, more benign substances. Bioremediation technologies often encourage contaminant degradation by enhancing site conditions such as oxygen availability, water, nutrients, and microorganisms. Three *in-situ* process options identified included bioreclamation, natural attenuation, and phytoremediation. Biological treatment was retained for evaluation as a corrective measures technology.

5.1.3.2 Chemical Treatment

Chemical treatment (e.g., chemical oxidation) involves using chemical reactions to transform organic compounds into more benign substances. Chemical treatment may include injection of chemicals such as ozone, peroxide, or other oxidizers. Chemical treatment was retained for evaluation as a corrective measures technology.

5.1.3.3 Physical Removal and Treatment

Physical treatment includes process options that separate or stabilize constituents in soil to prevent migration by various physical methods. These processes were eliminated from further consideration due to implementation difficulties associated with remediation of non-homogenous media in the field and their lack of long term reliability.

5.1.4 Summary Screening Technologies Retained for Soil Remediation

The following technologies were retained for further consideration for soil remediation:

- No Action
- Physical Barriers
- Legal Barriers
- Administrative Barriers
- Treatment

5.2 Groundwater

5.2.1 No Action

The No Action response assumes that no additional control measures will be implemented and no monitoring will be performed. As a result, no technologies or process options have been identified for the No Action response. Because some SWMUs have no identified groundwater contamination, No Action has been retained for further consideration as a corrective measures technology to serve as a basis of comparison between the existing and proposed control and/or groundwater treatment for the site.

5.2.2 Institutional Controls

The technologies identified for the Institutional Controls response includes Land Use Controls and Monitoring.

5.2.2.1 Land Use Controls

The corrective measures technology identified for the institutional controls response is Land Use Controls. Land Use Controls consists of physical, legal, and administrative mechanisms to restrict the use of or limit access to affected areas of the site to protect current and future receptors.

Given that the proposed remedies for each of the SMAs rely on a LUCP, it is anticipated that EPA's final remedy proposal will require an Environmental Covenant pursuant to the Alabama Uniform Environmental Covenants Act, Code of Alabama 1975, §§35-19-1 to 35-19-14. Such covenants are necessary if the final remedy places a land use control at a facility because it is not being remediated to unrestricted use.

5.2.2.2 Monitoring

The monitoring technology includes the long-term monitoring and monitored natural attenuation process options. These options provide for the collection and analysis of periodic groundwater

samples to monitor the concentration and/or degradation of constituents within groundwater. The long-term groundwater monitoring technology has been retained for further consideration as a corrective measures technology.

5.2.3 Containment

Potential containment technologies include the construction of horizontal or vertical barriers to "contain" or limit potential migration of groundwater. The containment technology identified for this site is a soil or asphalt/concrete cap/cover, which would significantly reduce the amount of infiltration of surface water through the affected soil. This process option has been retained for further consideration as a corrective measures technology.

5.2.4 Treatment

Treatment technologies identified for groundwater remediation at this site are biological, thermal and physical processes.

5.2.4.1 Biological Treatment

Biological treatment technologies typically use naturally occurring bacteria to break down constituents into simpler, more benign substances. Bioremediation technologies often encourage contaminant degradation by enhancing site conditions such as oxygen availability, water, nutrients, and microorganisms. Three *in-situ* process options identified included bioreclamation, natural attenuation, and phytoremediation. The process effective for remediation of organic contaminants (e.g., BaP) is typically not effective for the remediation of inorganic contaminants (e.g., metals). Therefore, biological treatment was not retained for further evaluation.

5.2.4.2 Thermal Treatment

Thermal treatment uses controlled high-temperature environments to oxidize organic compounds to produce carbon dioxide and water. Thermally enhanced groundwater vapor extraction was the process option identified for use to treat volatile and semi-volatile contaminated groundwater; however, due to logistics and costs, and this method being ineffective on inorganic contaminants, thermally enhanced groundwater vapor extraction was not retained for evaluation as a corrective measures technology.

5.2.4.3 Chemical Treatment

Chemical treatment (e.g., chemical oxidation) involves using chemical reactions to transform organic compounds into more benign substances. Chemical treatment may include injection of chemicals such as ozone, peroxide, or other oxidizers. Chemical treatment was retained for evaluation as a corrective measures technology.

5.2.4.4 Physical Removal and Treatment

Physical treatment includes process options that separate or stabilize constituents in groundwater to prevent migration by various physical methods. These processes were eliminated from further consideration due to implementation difficulties associated with remediation of non-homogenous media in the field and their lack of long term reliability.

In addition, hydraulic control of groundwater by using electrical or pneumatic pumps is a physical process. Once the groundwater is removed, chemical processes would be used to remove any contaminants from the groundwater. Treatment of recovered groundwater would be accomplished using the process water treatment system which eventually uses the existing BTF for final treatment. This treatment option has been retained for further consideration as a corrective measures technology.

5.2.5 Summary Screening Technologies Retained for Groundwater Remediation

The following technologies were retained for further consideration for groundwater remediation:

- No Action
- Physical Barriers
- Legal Barriers
- Administrative Barriers
- Long Term Groundwater Monitoring
- Treatment
- Physical Removal and Treatment

6.0 DEVELOPMENT OF CORRECTIVE ACTION ALTERNATIVES

Potential remedies for addressing contamination in site media are developed by assembling combinations of corrective measure technologies screened in Section 4.0 in order to meet the CAOs. Once Corrective Action Alternatives are developed, the alternatives will be compared against one another in Section 6.0. The Corrective Action Alternative chosen for the site will be recommended and justified in Section 7.0.

6.1 Corrective Measure Technology Screening

The corrective measure technologies (CMT) remaining from the screening process (Section 4.0) have been combined in this section to develop corrective action alternatives (CAA) for sediment, soil, and groundwater that meet the CAOs for SMA 4. The CMT and process options to be evaluated are listed in the table below:

Table 6-1
List of Corrective Measure Technologies and Process Options

No.	General Response Action	Corrective Measure Technology	Process Options
CMT1	No Action	None	None
CMT2	Institutional Actions	Land Use Controls	Physical Barriers (Fence/Signs)
CMT3	Institutional Actions	Land Use Controls	Legal Barriers
CMT4	Institutional Actions	Land Use Controls	Administrative Barriers
CMT5	Institutional Actions	Sampling or Monitoring	Soil Sampling or Groundwater LTM
CMT6	Containment	Capping	Soil Cap/Asphalt of Concrete Cover
CMT7	Treatment	Chemical Treatment	In-Situ Injection for Soil and/or Groundwater
CMT8	Removal and Disposal	Excavation	Targeted Soil Removal

CMT=Corrective Measure Technology

The CMTs listed in the above table were evaluated individually for each media and each exposure pathway in terms of satisfying the components of the CAOs developed for the site. If the implementation of a given CMT would result in the partial attainment of the CAOs for that media in tables 5-2 and 5-3, then it was assigned a yes and selected as a corrective measure technology. When all of the individual media and exposure pathways had been assessed individually, then the individual CMTs were combined to form CAAs that are presented in Table 5-4.

Table 6-2
Evaluation and Screening of Potential
Corrective Measure Technologies for Subsurface Soil

No.	General Response Action	Corrective Action Technology (Process Option)	Subsurface Soil	
			Satisfy CAO for Construction Worker?	Satisfy CAO for Industrial Worker?
CMT1	No Action	None	NO	NO
CMT2	Institutional Actions	Physical Barriers (Fence/Signs)	**YES**	**YES**
CMT3	Institutional Actions	Legal Barriers	**YES**	**YES**
CMT4	Institutional Actions	Administrative Barriers	**YES**	**YES**
CMT5	Containment	Soil Cap or Asphalt/Concrete Cover	NA	NA
CMT6	Treatment	In-Situ Injection	NA	NA
CMT7	Removal and Disposal	Targeted Excavation and Disposal	NA	NA

CMT=Corrective Measure Technology
NA = Not Applicable since the PCSs in subsurface soil were not exceeded.

Based on the results of the evaluation as summarized in Table 5-2, the following CMTs met the requirements of the set of CAOs for subsurface soil in SMA 4 and were selected to be combined with other media remedial options to form corrective action alternatives:

CMT1: No Action (to serve as a baseline)
CMT2 + CMT3 + CMT4: Land Use Controls (Administrative and Physical)

Table 6-3
Evaluation and Screening of Potential
Corrective Measure Technologies for Groundwater

No.	General Response Action	Corrective Action Technology (Process Option)	Groundwater	
			Satisfy CAO for Construction Worker?	Satisfy CAO for Industrial Worker?
CMT1	No Action	None	NO	NO
CMT2	Institutional Actions	Physical Barriers (Fence/Signs)	**YES**	**YES**
CMT3	Institutional Actions	Legal Barriers	**YES**	**YES**
CMT4	Institutional Actions	Administrative Barriers	**YES**	**YES**
CMT5	Institutional Actions	Groundwater Long Term Monitoring	**YES**	**YES**
CMT6	Chemical Treatment	In-Situ Injection	**YES**	**YES**
CMT7	Physical Removal and Treatment	Groundwater Pumping and Treatment	**YES**	**YES**

CMT=Corrective Measure Technology

Based on the results of the evaluation as summarized in Table 5-3, the following CMTs met the requirements of the set of CAOs for groundwater in SMA 4 and were selected to be combined with other media remedial options to form CAAs:

CMT1:	No Action (to serve as a baseline)
CMT2 + CMT3 + CMT4:	Land Use Controls (Administrative and Physical)
CMT5:	Groundwater Long Term Monitoring (LTM)
CMT6:	Chemical Treatment
CMT7:	Physical Removal and Treatment

6.2 Corrective Action Alternatives

The corrective action alternatives selected for SMA 4 were intended to represent a broad spectrum of remedial options, ranging from alternatives such as land use controls that prevent or control exposure to active alternatives that employ treatment to reduce toxicity, mobility, or volume.

A total of five corrective action alternatives have been developed by combining the corrective measure technologies screened in Section 5.1 to satisfy the CAOs for the contaminated media present in SMA 4. Parameters specific to SMA 4, including the variation of site activities and areas of exposure associated with the industrial worker and construction worker scenarios, allowed for adequate differentiation among the six alternatives with respect to effectiveness, implementability, and cost. Although groundwater monitoring is not a corrective measure technology that will satisfy the CAOs, it is used in conjunction with other groundwater remedial options to determine the effectiveness of those remedial options as they are implemented. The corrective action alternatives (CAA) for the site are listed below:

- CAA 1 No Action
- CAA 2 Physical , Legal , and Administrative Barriers (Land Use Controls)
- CAA 3 Land Use Controls + Groundwater LTM
- CAA 4 Land Use Controls + In-Situ Soil Source Area Treatment + In-Situ Groundwater Treatment + Groundwater Monitoring
- CAA 5 Land Use Controls + In-Situ Soil Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring

Additional components of these alternatives with respect to the impacted media at the site are listed in the table below:

Table 6-4
Components of the Multi-Media Corrective Action Alternatives

	Corrective Action Alternatives				
Components	1	2	3	4	5
Soil/Sediment					
No Action	..				
Land Use Controls		..	..	..	..
Groundwater					
No Action	..				
Land Use Controls		..	..	..	..
Groundwater LTM			..	..	..

	Corrective Action Alternatives				
Components	1	2	3	4	5
Chemical Treatment				..	..
Physical Removal and Treatment					..

A detailed description of each alternative is provided in the subsections below.

6.2.1 CAA 1—No Action

The No Action corrective action alternative assumes that no further remedial action will occur at SMA 4 and has been included to establish a baseline for alternative comparison. Alternative 1 can include limited environmental monitoring to assess the impacts associated with no remedial response action, but cannot include actions to minimize risk by reducing either contaminant exposure pathway or contamination through treatment.

6.2.2 CAA 2— Physical , Legal , and Administrative Barriers (Land Use Controls)

The Physical Barrier, Legal Barrier, and Administrative Barrier (Institutional Control) alternatives consist of administrative and physical mechanisms to place restrictions on the use of and limit access to the site and/or SWMUs/AOCs to prevent exposure to site contaminants. SMA 4 is completely fenced, and the facility is manned twenty-four hours a day 365 days a year.

Applying land use controls at SMA 4 will maintain the site as industrial going forward to:

- prevent the site from becoming a future unrestricted residential land use scenario (i.e., to keep the land use industrial).
- be consistent with land use controls proposed to address conditions at the other 4 SMAs at the facility.
- be protective of higher levels of contamination, if any, that may not have been detected by sampling within 4.
- be conservative and protective down to one order of magnitude below the recommended cancer risk level.

A LUCP would be prepared according to USEPA guidance developed in 2012 (http://www.epa.gov/superfund/policy/ic/guide/index.htm). The LUCP would identify the objective of the controls to restrict activities within the SMA 4 boundary, list the actions necessary to achieve the objective, and warn potential human receptors of the contaminants at the site. The LUCP is intended to protect current and future receptors and consists of physical, legal, and administrative land use controls. The LUCP would include the following information:

- A description of the land along with the certified land survey location of the boundary with respect to state plane coordinates,
- Placing a deed restriction on the property to limit the site to industrial/commercial land use.
- Placing a deed restriction on the property to limit the use of groundwater.
- An explanation of the land use control including permits to perform any digging activities and the proper personal protective equipment (PPE) that must be used to protect workers, and the use of a fence and signs as necessary to prevent unauthorized access,
- Identification of the facility program point-of-contact designated responsible for implementing the LUCP,
- An on-site compliance monitoring program,
- Notification procedures to USEPA and ADEM whenever the facility anticipates a major change in land use,
- An annual field inspection and report submitted to USEPA and ADEM to document the effectiveness of the land use controls,
- A certification of the annual report by the designated official to continue compliance with the LUCP,
- A procedure to notify USEPA and ADEM immediately upon discovery of any unauthorized major change in land use or any activity inconsistent with the LUCP and the actions that would be implemented to ensure protectiveness, and
- A procedure to provide advance notification to EPA and ADEM of impending transfer, by sale or lease, of SMA 4.

6.2.3 CAA 3 — Land Use Controls + Groundwater Monitoring

The *Land Use Controls and Groundwater Monitoring* alternative consists of a combination of technologies including administrative land use controls and long term groundwater monitoring. This alternative would meet the corrective measure objectives by monitoring the affected site groundwater to ensure the apparent groundwater plume (AOC D) dynamics are acceptable and implementing a LUCP to protect future receptors in the unlikely event the land use changes.

6.2.3.1 Land Use Controls

The Land Use Control that would be implemented in conjunction with the groundwater monitoring would be a LUCP as described in Section 5.2. The LUCP is intended to protect current and future receptors and consists of physical, legal, and administrative land use controls.

6.2.3.2 Groundwater Monitoring

A plume of groundwater containing VOCs has been identified in SMA 4. Historic groundwater monitoring results have shown that the plume had extended to just off of the site to the east but operation of the interim measure has drawn the plume back toward the facility significantly. The plume has been defined. A long-term groundwater monitoring program would be developed to monitor the effectiveness of the selected corrective action.

6.2.4 CAA 4 — Land Use Controls + In-Situ Soil Source Area Treatment + In-Situ Groundwater Treatment + Groundwater Monitoring

The *Land Use Controls, In-Situ Soil Source Area Treatment, In-Site Groundwater Treatment, and Groundwater Monitoring* alternative consists of a combination of technologies including administrative land use controls, in-situ injection for treating subsurface soil and groundwater, and groundwater monitoring. This alternative would meet the corrective measure objectives by reducing and/or eliminating exposure to the affected site media (see Section 3.3) through injection of bacteria or chemicals to remove contaminants in the soil source areas and groundwater; and the development and implementation of a LUCP to protect theoretically possible future receptors in the unlikely event the land use changes. In addition, a long-term groundwater monitoring program will be developed to monitor the effectiveness of the selected corrective action.

6.2.4.1 Land Use Controls

The Land Use Control that would be implemented in conjunction with the groundwater monitoring would be a LUCP as described in Section 6.2.2. The LUCP is intended to work in conjunction with the treatment of soil and groundwater to prevent exposure to contaminated media during the remediation process.

6.2.4.2 In-situ Treatment

Soil source areas and groundwater containing various constituents are present in SMA 4: The soil source area and groundwater plume could be treated in-situ with various types of chemicals or bacteria. If the alternative is chosen, bench scale studies would be conducted to determine the appropriate chemicals or bacteria to be used. In-situ treatment may:

- Reduce concentrations to below the established PCSs to the extent practicable, and
- Function with minimum maintenance.

6.2.4.3 Groundwater Monitoring

A long-term groundwater monitoring program would be developed to monitor the effectiveness of the in-situ groundwater treatment.

6.2.5 CAA 5 — Land Use Controls + In-Situ Soil Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring

The *Land Use Controls, In-Situ Soil Source Area Treatment, Groundwater Removal and Treatment, and Groundwater Monitoring* alternative consists of a combination of technologies including administrative land use controls, in-situ injection for treating soil source area (including ancillary benefit to groundwater), hydraulic control and groundwater treatment, and groundwater monitoring. The groundwater plume identified in SMA 4 (AOC D) would be pumped to gain hydraulic control of the plume and to remove contaminants. The water removed from the plume would be used as process water and treated in the plants light oil process stream. The pumping would serve as a hydraulic control to control, and potentially reverse, migration of the plume, and a means for recovering and treating the plume. A long-term groundwater monitoring program will be developed to monitor the effectiveness of the selected corrective action.

6.2.5.1 Land Use Controls

The Land Use Control that would be implemented in conjunction with the groundwater monitoring would be a LUCP as described in Section 5.2. The LUCP is intended to work in conjunction with the treatment of soil and groundwater to prevent exposure to contaminated media during the remediation process.

6.2.5.2 In-situ Soil Source Area Treatment

Soil source areas containing various constituents are present in SMA 4: The soil source areas could be treated in-situ with various types of chemicals or bacteria. If the alternative is chosen, bench scale studies would be conducted to determine the appropriate chemicals or bacteria to be used. In-situ treatment may reduce soil concentration in the source areas to below the established PCSs and GWP SSLs. In addition, groundwater will also be treated as an ancillary benefit of the treatment of the soil source areas. This will also help to reduce contaminant mass within the groundwater plume, in addition to the removal and treatment described below.

6.2.5.3 Groundwater Removal and Treatment

In addition to the in-situ source area treatment, groundwater hydraulic control wells would be installed in SMA 4 in order to contain the plume associated with AOC D and to reduce the size of the plume. The hydraulic control system will also aid in moving bacteria/chemicals injected in association with soil source areas treatment toward the hydraulic control wells located on the

periphery of the groundwater plume. This will increase the treatment area of the bacteria/chemicals injected in the source areas. The hydraulic control well network will be designed to control the entire plume. The water removed from the plume would be used as process water and treated in the plants light oil process stream. The process water eventually is treated at the ERP Coke Biological Treatment Facility (BTF).

6.2.5.4 Groundwater Monitoring

A groundwater monitoring program as described in Alternative 3 in Section 5.2.3.2 would be used to ensure that the apparent plume does not migrate beyond the facility boundary and determine the effectiveness of the groundwater removal and treatment.

7.0 EVALUATION OF THE CORRECTIVE ACTION ALTERNATIVES

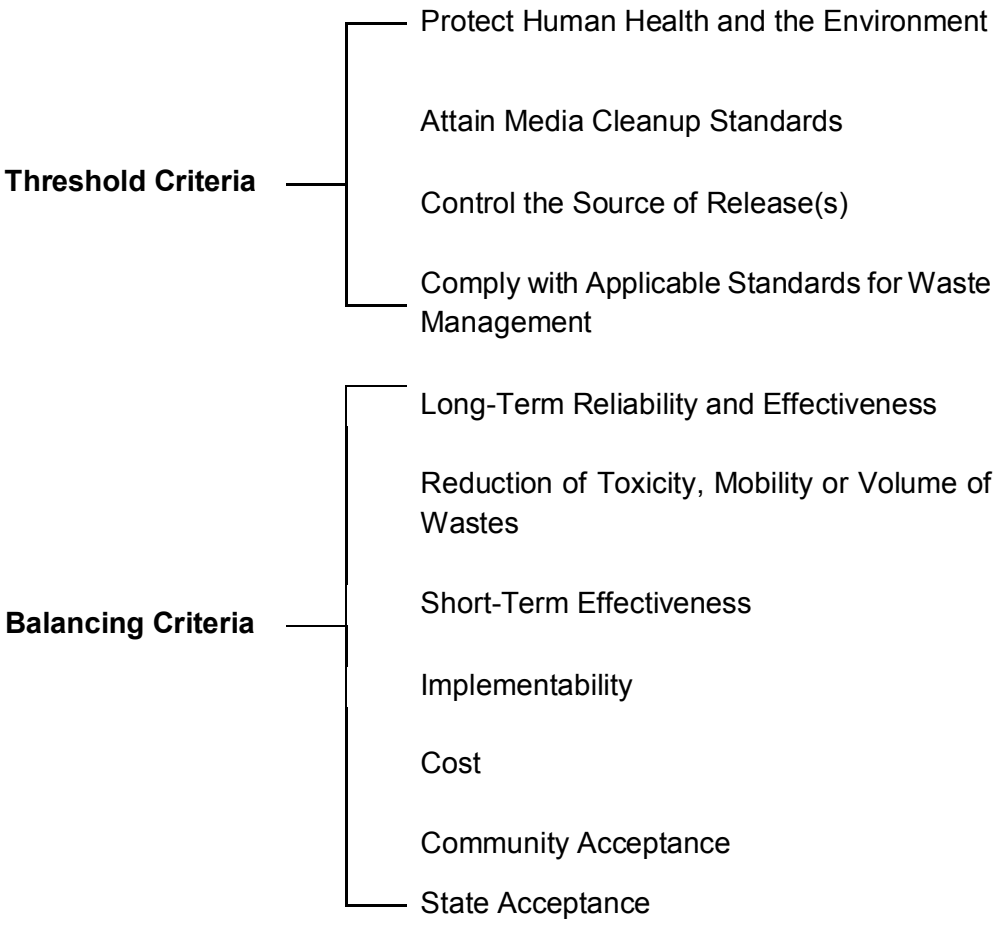
The purpose of the detailed analysis is to provide risk managers with a baseline for evaluating alternatives and selecting the appropriate site remedy. A typical detailed analysis consists of the following components:

- An assessment and summary profile of each alternative individually against the evaluation criteria.
- A comparative analysis among the alternatives to assess the relative performance of each alternative with respect to each evaluation criterion.

This section presents a detailed analysis of the corrective measure alternatives proposed for SMA 4 and summarizes the degree to which each alternative will comply with the requirements of the evaluation criteria.

7.1 Evaluation Criteria

To assist in the evaluation of five corrective action alternatives (CAA) developed for this site, nine of the eleven evaluation criteria presented in the Advanced Notice of Proposed Rulemaking (ANPR), *Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities* (USEPA 1996) were used to assess, weigh, and rank the proposed alternatives. As described in the USEPA guidance, the criteria are separated into two groups - threshold criteria and balancing criteria, as summarized below:



7.1.1 Threshold Criteria

The four threshold criteria are described below:

- ***Protect Human Health and the Environment:*** Alternatives are evaluated to determine if implementation will provide and maintain adequate protection of human health and the environment by eliminating, reducing, or controlling site exposures to acceptable risk levels established in the corrective action objectives.

- ***Attain Media Cleanup Standards:*** Alternatives are evaluated to determine if their implementation would result in the attainment of media cleanup standards derived from existing state or federal regulations, as well as site-specific PCSs. In addition, the time frame necessary for the alternative to meet the standards is included.

- ***Control the Source of Releases:*** Alternatives are evaluated to determine if their implementation would control or eliminate current and future releases (to the extent possible) that may pose a threat to human health and the environment.

- ***Comply with Applicable Standards for Waste Management:*** Alternatives are evaluated to determine if waste management activities associated with the implementation of each alternative would be conducted in compliance with all applicable state or federal regulations.

7.1.2 Balancing Criteria

The five balancing criteria are described below:

- ***Long-Term Reliability and Effectiveness:*** Alternatives are evaluated with respect to their demonstrated and expected reliability and permanence based on the degree of certainty that the alternative would prove to be successful in establishing controls to eliminate or manage the risk posed by treatment residuals and/or untreated wastes. Each alternative is also evaluated in terms of its projected useful life (i.e., the length of time the level of effectiveness can be maintained).

- ***Reduction of Toxicity, Mobility, or Volume of Wastes:*** Alternatives are evaluated to determine the degree to which their implementation would reduce or eliminate the toxicity, mobility, or volume of waste at the site. This evaluation focuses on specific factors, including the amount of hazardous materials that will be destroyed or treated, the expected reduction of the toxicity, mobility, and volume, the degree to which the treatment will be irreversible, and the type and quantity of treatment residuals.

- ***Short-Term Effectiveness:*** Alternatives are evaluated with respect to the short-term risks that might be posed to the community, workers, and the environment during the construction and implementation of the alternative. Each alternative is also evaluated in terms of the time that site conditions are protective of human health and the environment.

- ***Implementability:*** Alternatives are evaluated in terms of the ease or difficulty of their implementation considering the technical and administrative feasibility. Technical feasibility includes difficulties and unknowns associated with constructability, time for implementation, time for beneficial results, and availability of technologies, as well as the availability of adequate off-site treatment, storage capacity, disposal services, and technical services and materials. Administrative feasibility includes permits, rights of way, and off-site approvals and the length of time necessary to obtain any approvals.

- ***Cost:*** Alternatives are evaluated in terms of the net present value of capital costs and the present worth of the annual operation and maintenance costs. Capital costs consist of

direct costs and indirect costs. Direct costs include labor, equipment, and materials expenditures necessary to install the corrective measure. Indirect costs include engineering, financial, and other service fees apart from installation activities. Cost analyses for the corrective action alternatives are derived from a number of sources, including vendor estimates, estimates from similar projects, actual experience at other sites, and standard costing guidance references. With respect to CERCLA, remedial action alternatives requiring perpetual care are limited to thirty years (USEPA, 2000). This same limitation will be used for costing the corrective action alternatives presented in this document.

- ***Community Acceptance:*** The final CMS will be placed on public notice. The public will then be able to comment on the proposed remedies. This balancing criteria will not be addressed further in this document since EPA will take this criteria into account during the public notice process for the Statement of Basis.

- ***State Acceptance:*** EPA will evaluate the remedies based on the degree to which they are acceptable to the State of Alabama in which the subject facility is located. This is particularly important where EPA, not the State, selects the remedy. This balancing criteria will not be addressed further in this document since EPA will take this criteria into account during the public notice process for the Statement of Basis.

7.2 Individual Analysis of the CAAs

This section consists of the evaluation of the relative performance of each of the five alternatives selected for SMA 4 individually in terms of the four threshold criteria described above. Several questions are asked for each of the four threshold criteria. The threshold criteria must be met for each remedy under consideration in order for it to move forward for additional consideration. The threshold criteria are scored either yes, no, or not applicable (NA). The NA response would also be a positive answer for the threshold criteria.

The SWMUs and AOCs potentially subject to corrective action in SMA 4 are grouped as follows:

- Surface Soil – AOC B
- Subsurface Soil – SWMU 26, SWMU 27, SWMU 28, SWMU 29, SWMU 30, SWMU 31, SWMU 32, SWMU 33, SWMU 34, SWMU 42
- Groundwater – AOC D

Surface soil contamination is deemed not to warrant active remediation based on the results of the HHRA. Therefore, surface soil is only applicable to the LUCP portion of the CAAs since the HHRA only considered industrial/commercial land use risks.

Risks to human health from subsurface soil contamination are also not considered to warrant active remediation based on the results of the HHRA. However, the potential leaching of some constituents from soil to groundwater was noted. Therefore, subsurface soil source areas containing relatively higher concentrations of these constituents would be subject to treatment in some of the CAAs to address this apparent leaching potential.

Groundwater contamination is considered to need active remediation based on the results of the HHRA for the construction worker and industrial worker scenarios. The CAAs have been prepared to compare alternatives to most effectively remediate the groundwater.

7.2.1 CAA 1 — No Action

Under CAA 1, no action would be taken to mitigate or remediate conditions at the site or control exposure of receptors to the contaminated media. Therefore, the site would remain as it currently exists. The detailed analysis of CAA 1 with respect to the four threshold criteria is described in detail below and summarized in Table 7-1.

CAA 1 - Protect Human Health and the Environment: The environment is protected since there are no ecological receptors in SMA 4. However, the No Action alternative may not achieve the USEPA *de minimis* risk range of 1E-04 to 1E-06 for residential use because this SMA was assessed primarily for industrial and construction scenarios. However, contamination at levels exceeding residential risk screening levels has been detected. Although residential use is unanticipated, no institutional controls would be taken under Alternative 1 to ensure that the land use remains industrial. Based on the information above, the implementation of this alternative would not meet the requirements of this threshold criterion.

CAA 1 - Attain Media Cleanup Standards: The risks assessed for this SMA were for industrial and construction scenarios. However, contamination at levels exceeding residential risk screening levels has been detected. Although residential use is unanticipated, no institutional controls would be taken under Alternative 1 to ensure that the land use remains industrial. Therefore, the implementation of this alternative would not meet the requirements of this threshold criterion.

CAA 1 - Control the Source of Releases: Because there are affected media that have not been, capped, removed, or contained, the implementation of this alternative would not meet the requirements of this threshold criterion.

CAA 1 - Comply with Applicable Standards for Waste Management: Since no actions would be performed under this alternative, no wastes would be generated. The requirements of this threshold criterion would be met.

Table 7-1. Summary of Threshold Criteria
CAA 1 – No Action

Evaluation Criteria	Specific Criteria Factor Considerations		
Protect Human Health and the Environment	Would exposure be controlled, reduced, or eliminated?	No	
			No
Attain Media Cleanup Standards	Will cleanup goals for surface exposure be met?	No	
	Will cleanup goals for subsurface exposure be met?	No	
			No
Control Source of Releases	Are further releases reduced or eliminated?	No	
	Is the time frame for attaining the media cleanup standards short?	No	
			No
Comply With Standards for Waste Management	Will waste handling activities be performed in accordance with state and federal regulations?	Yes	
			Yes

Since CAA 1 fails three of the four threshold Criteria, it will not move forward for comparisons to the balancing criteria.

7.2.2 CAA 2 — Physical , Legal , and Administrative Barriers (Land Use Controls)

This alternative involves the restriction of access and activities at the site through the installation of fencing, signage and the development of a LUCP. The detailed analysis of CAA 2 with respect to the four threshold criteria is described in detail below and summarized in Table 7-2.

CAA 2 - Protect Human Health and the Environment: CAA 2 provides fencing, signage, and/or land use controls to reduce the exposure of receptors in SMA 4. The area of SMA 4 is currently inside the fenced and secured area of the facility. The exposure of the authorized visitors (i.e., the maintenance and on-site workers) to the affected media would be reduced through controls such as PPE requirements and dig permits or restrictions that would be outlined in the LUCP. This alternative would not reduce the levels of contamination in in SMA 4 below the cumulative industrial/commercial ELCR of 10-4 or HI of 1.0; however, the LUCP would prevent complete exposure pathways. Therefore, this threshold criterion would be met.

CAA 2 - Attain Media Cleanup Standards: Subsurface soils exceeding the PCS would be left in place under this scenario; therefore, this threshold criterion would not be met.

CAA 2 - Control the Source of Releases: Because affected media would not be remediated under this CAA, the CAA would not actively reduce the potential, if any, for further releases. Since no active remediation would be conducted under this scenario, cleanup time would be many years. The implementation of this alternative would not meet the requirements of this threshold criterion.

CAA 2 - Comply with Applicable Standards for Waste Management: Since no remedial actions will be performed under this alternative, no wastes will be generated. The requirements of this threshold criterion would be met.

Table 7-2. Summary of Threshold Criteria
CAA 2 – Physical, Legal , and Administrative Barriers (Land Use Controls)

EVALUATION CRITERIA	SPECIFIC CRITERIA FACTOR CONSIDERATIONS		
Protect Human Health and the Environment	Would exposure be controlled, reduced, or eliminated?	Yes	
			Yes
Attain Media Cleanup Standards	Will cleanup goals for surface exposure be met?	Yes	
	Will cleanup goals for subsurface exposure be met?	No	
			No
Control Source of Releases	Are further releases reduced or eliminated?	No	
	Is the time frame for attaining the media cleanup standards short?	No	
			No
Comply With Standards for Waste Management	Will waste handling activities be performed in accordance with state and federal regulations?	Yes	
			Yes

Since CAA 2 fails three of the four threshold Criteria, it will not move forward for comparisons to the balancing criteria.

7.2.3 CAA 3 — Land Use Controls + Groundwater Monitoring

Under this alternative, a long term groundwater monitoring plan would be implemented and a LUCP would be developed. The detailed analysis of CAA 3 with respect to the four threshold criteria is described in detail below and summarized in Table 7-3.

CAA 3 - Protect Human Health and the Environment: CAA 3 provides fencing, signage, and land use controls to reduce the hypothetical exposure of receptors in SMA 4. The area of SMA 4 is currently fenced and secured. The exposure of the authorized visitors (i.e., the maintenance and on-site depot workers) to the affected media will be reduced to acceptable levels through controls such as PPE requirements and dig permits or restrictions that would be outlined in the LUCP. In addition, a long-term groundwater monitoring plan would be prepared. Once approved, the long-term groundwater monitoring would provide information on groundwater concentrations in SMA 4. This alternative would not reduce the levels of contamination in in SMA 4 below the cumulative industrial/commercial ELCR of 10-4 or HI of 1.0; however, the LUCP would prevent complete exposure pathways. Therefore, this threshold criterion would be met.

CAA 3 - Attain Media Cleanup Standards: Soils exceeding the PCS would be left in place under this scenario; therefore, this threshold criterion would not be met.

CAA 3 - Control the Source of Releases: Because affected media would not be remediated under this CAA, the CAA would not actively reduce the potential, if any, for further releases is not reduced or eliminated. The implementation of this alternative would not meet the requirements of this threshold criterion.

CAA 3 - Comply with Applicable Standards for Waste Management: Purged groundwater would be generated during groundwater monitoring; however, it would be properly managed. Therefore, the requirements of this threshold criterion would be met.

Table 7-3. Summary of Threshold Criteria
CAA 3 – Land Use Controls + Groundwater Monitoring

EVALUATION CRITERIA	SPECIFIC CRITERIA FACTOR CONSIDERATIONS		
Protect Human Health and the Environment	Would exposure be controlled, reduced, or eliminated?	Yes	
			Yes
Attain Media Cleanup Standards	Will cleanup goals for surface exposure be met?	Yes	
	Will cleanup goals for subsurface exposure be met?	No	
			No
Control Source of Releases	Are further releases reduced or eliminated?	No	
	Is the time frame for attaining the media cleanup standards short?	No	
			No
Comply With Standards for Waste Management	Will waste handling activities be performed in accordance with state and federal regulations?	Yes	
			Yes

Since CAA 3 fails three of the four threshold Criteria, it will not move forward for comparisons to the balancing criteria.

7.2.4 CAA 4 — Land Use Controls + In-Situ Soil Source Area Treatment + In-Situ Groundwater Treatment + Groundwater Monitoring

Under this alternative, chemicals or bacteria would be injected into contaminated soil source areas and groundwater in-situ. A long term groundwater monitoring plan would be implemented to monitor the effectiveness of the in-situ treatment, and a LUCP would be developed. The detailed analysis of CAA 4 with respect to the four threshold criteria is described in detail below and summarized in Table 7-4.

CAA 4 - Protect Human Health and the Environment: CAA 4 provides in-situ treatment of the soil source areas and groundwater to minimize the exposure to hypothetical current and future receptors. The exposure of the authorized visitors (i.e., the maintenance and on-site workers) to the affected media would be reduced through controls such as PPE requirements and dig permits or restrictions that would be outlined in the LUCP. In addition, the LUCP would ensure that the

site remains in industrial/commercial use in order to protect any residential receptors. The soil source areas and groundwater have concentrations exceeding the cumulative industrial/commercial ELCR of 10-4 or HI of 1.0. The in-situ treatment of the soil source areas and groundwater could reduce the contaminant concentrations to below the cumulative industrial/commercial ELCR of 10-4 or HI of 1.0. Land use controls will also be used to block the exposure pathways for otherwise potential future residential receptors. Long term groundwater monitoring would be needed to verify that in-situ treatment achieves the PCSs established for subsurface soil and groundwater. If the in-situ treatment is effective, it would protect human health and the environment. CAA 4 could meet this threshold criteria.

CAA 4 - Attain Media Cleanup Standards: The medium-specific cleanup standards for the soil source areas and groundwater would be achieved by in-situ treatment to reduce concentrations to the PCS (to be confirmed by confirmatory sampling and analysis). The timeframe for obtaining the media cleanup standards would be relatively short compared to natural attenuation depending on the number of injections required to reduce contaminant concentrations to levels below the PCS.

The groundwater plume is approximately 800 feet long by 550 feet wide. The majority of the groundwater flow is limited to a thickness of approximately 3 feet. Based on this estimation there is approximately 2 million gallons of contaminated water. The groundwater velocity of the site is approximately 64 feet per year as calculated during the Phase III RFI. Assuming in-situ treatment of groundwater at the upgradient boundary of the plume and in-situ treatment of the soil source area, it would take approximately 11 years for the in-situ treatment media to travel through the plume to the downgradient boundary. If in-situ treatment media was introduced on the upgradient boundary and at the middle of the plume, the timeframe would be reduced to approximately 4 years. It is likely injection of treatment media would need to occur multiple times since the injected media would be degraded while breaking down the contaminants. Based on these assumptions, the currently estimated timeframe for obtaining the media cleanup standards is 10 to 15 years. The point of compliance to meet the PCS and MCLs is on average throughout the plume. CAA 4 would meet the requirements of this threshold criterion.

CAA 4 - Control the Source of Releases: The in-situ treatment of the soil source areas and groundwater to cleanup standards would more than effectively control any risk of additional groundwater releases. Multiple in-situ injection event over time may be needed. CAA 4 meets the requirement of this threshold criterion.

CAA 4 - Comply with Applicable Standards for Waste Management: All of the wastes generated under this alternative would be managed according to the state and federal regulations associated with treatment. Therefore, the requirements of this threshold criterion would be met.

Table 7-4. Summary of Threshold Criteria
CAA 4 – Land Use Controls +In-Situ Soil Source Area Treatment + In-Situ Groundwater Treatment + Groundwater Monitoring

EVALUATION CRITERIA	SPECIFIC CRITERIA FACTOR CONSIDERATIONS		
Protect Human Health and the Environment	Would exposure be controlled, reduced, or eliminated?	Yes	
			Yes
Attain Media Cleanup Standards	Will cleanup goals for surface exposure be met?	Yes	
	Will cleanup goals for subsurface exposure be met?	Yes	
			Yes
Control Source of Releases	Are further releases reduced or eliminated?	Yes	
	Is the time frame for attaining the media cleanup standards short?	Yes	
			Yes
Comply With Standards for Waste Management	Will waste handling activities be performed in accordance with state and federal regulations?	Yes	
			Yes

Since CAA 4 meet the four threshold Criteria, it will move forward for comparisons to the balancing criteria.

7.2.5 CAA 5 — Land Use Controls + In-Situ Soil Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring

CAA 5 includes the in-situ treatment of the soil source areas (including groundwater in the immediate vicinity) and removal and treatment of the contaminated groundwater. A long term groundwater monitoring plan would be implemented to monitor the effectiveness of the remediation, and a LUCP would be developed. The detailed analysis of CAA 5 with respect to the four threshold criteria is described in detail below and summarized in Table 7-5.

CAA 5 - Protect Human Health and the Environment: CAA 5 provides for the in-situ treatment of soil source areas (with ancillary treatment of groundwater) and also provides for the removal and treatment of groundwater, all to minimize the exposure to hypothetical current and future receptors. The exposure of the authorized visitors (i.e., the maintenance and on-site workers) to the affected media would be reduced through controls such as PPE requirements and dig permits or restrictions that would be outlined in the LUCP. In addition, the LUCP would ensure that the site remains in industrial/commercial use in order to protect any residential receptors. The soil source areas and groundwater have concentrations exceeding the PCSs. The in-situ treatment of soil source area could reduce the contaminant concentrations to below the PCSs and prevent recontamination of groundwater. The removal and treatment of the contaminated groundwater will result in removal of contaminants. Land use controls will also be used to block the exposure pathways for otherwise potential future residential receptors. Long term groundwater monitoring would be needed to verify that in-situ soil source area treatment and groundwater removal and treatment achieves the PCSs established for subsurface soil and groundwater. If this combination

of treatments are effective, it would protect human health and the environment. CAA 4 could meet this threshold criteria.

There are no ecological receptors in SMA 4; therefore, ecological risk is not applicable for SMA 4.

CAA 5 - Attain Media Cleanup Standards: The soil source area specific cleanup standards would be expected to be achieved by in-situ soil source area treatment, and the groundwater cleanup standard would be expected to be achieved by hydraulic control and treatment of the groundwater in SMA 4 (although groundwater will receive some ancillary treatment from the in-situ soil source area treatment, as well). The in-situ treatment of the residual contamination in the soil source areas will help achieve the cleanup standards for the subsurface soil. The recovered groundwater will be reused as process water for the plant's light-oil system. The water used in this process is treated through the on-site biological treatment plant. Through this removal of the groundwater contaminants, cleanup standards will be achieved. Soil verification sampling and long-term groundwater monitoring and analysis will be used to verify that CAA 5 is effective.

The groundwater plume is approximately 800 feet long by 550 feet wide. The majority of the groundwater flow is limited to a thickness of approximately 3 feet. Based on this estimation there is approximately 2 million gallons of contaminated water. Currently the hydraulic control system is removing approximately 1.6 million gallons of groundwater per year. Assuming the in-situ treatment of the soil source area could prevent residual contamination leaching from the soil, it would take less than 2 years to remove the entire volume of contaminated water. It is likely injection of treatment media to the soil source areas would need to occur multiple times to completely treat the relevant soil to prevent contaminants from leaching to groundwater. Since groundwater flow is not homogeneous due to the fracture flow, it may take time for some diffusion of contaminants from low flow areas to be captured by the hydraulic control system. Based on these assumptions, the currently estimated timeframe for obtaining the media cleanup standards is 5 to 10 years. The point of compliance to meet the PCS and MCLs is on average throughout the plume. CAA 5 would meet the requirements of this threshold criterion.

CAA 5 - Control the Source of Releases: The in-situ treatment of the soil source areas would more than effectively control any risk of additional releases to groundwater from existing soil conditions. This will allow the hydraulic control to capture and treat the groundwater as needed to achieve cleanup standards. CAA 5 meets the requirement of this threshold criterion.

CAA 5 - Comply with Applicable Standards for Waste Management: The wastes generated under this alternative would be managed according to the state and federal regulations associated with treatment and disposal. Therefore, the requirements of this threshold criterion would be met.

Table 7-5. Summary of Threshold Criteria
CAA 5 – Land Use Controls + In-Situ Soil Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring

EVALUATION CRITERIA	SPECIFIC CRITERIA FACTOR CONSIDERATIONS		
Protect Human Health and the Environment	Would exposure be controlled, reduced, or eliminated?	Yes	
			Yes
Attain Media Cleanup Standards	Will cleanup goals for surface exposure be met?	Yes	
	Will cleanup goals for subsurface exposure be met?	Yes	
			Yes
Control Source of Releases	Are further releases reduced or eliminated?	Yes	
	Is the time frame for attaining the media cleanup standards short?	Yes	
			Yes
Comply With Standards for Waste Management	Will waste handling activities be performed in accordance with state and federal regulations?	Yes	
			Yes

Since CAA 5 meets the four threshold Criteria, it will move forward for comparisons to the balancing criteria.

7.3 Comparative Analysis

This comparative analysis identifies the advantages and disadvantages of each alternative which met the four threshold criteria relative to one another using the balancing criteria to enable the risk managers to identify key tradeoffs. The relative performance of each alternative has been evaluated in relation to each of five balancing criteria: long-term reliability and effectiveness; reduction of toxicity, mobility, or volume of waste; short-term effectiveness; implementability; and cost. The balancing criteria are then scored on a scale of 0 to 5 with high being the highest score. If a particular criteria has more than one question, the average of the ratings are calculated to establish the criteria rating. A maximum balancing criteria score of 25 is possible for each CAA. Since this is only relative based on five of the balancing criteria, the chosen CAA may not receive the highest score. A particular balancing criteria may have an overriding effect on the CAA chosen.

CAA 4 – Land Use Controls + In-Situ Soil Source Area Treatment + In-Situ Groundwater Treatment + Groundwater Monitoring and CAA 5 – Land Use Controls + In-Situ Soil Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring are the only two CAAs to satisfy each of the four threshold criteria of the CAAs evaluated; therefore, CAA 4 and CAA 5 will be evaluated with respect to the five balancing criteria.

7.3.1 Balancing Criteria for CAA 4 — Land Use Controls + In-Situ Soil Source Area Treatment + In-Situ Groundwater Treatment + Groundwater Monitoring

CAA 4 - Long–Term Reliability and Effectiveness: The in-situ treatment of the affected groundwater in SMA 4 would provide an initial reduction in contaminant concentrations; however, the long-term reliability of this treatment is less clear. The potential challenge of reaching all of the contaminated media in fractured bedrock is an additional complication. The long-term groundwater monitoring will assist in evaluating the effectiveness of the in-situ treatment. If multiple treatments were effective, the estimated useful life of the in-situ treatment would be greater than 30 years. CAA 4 partially satisfies this balancing criterion.

CAA 4 - Reduction of Toxicity, Mobility, or Volume of Wastes: CAA 4 effectively reduces the toxicity, mobility, and volume of contaminated groundwater; however, due to the heterogeneity of the site, fully achieving groundwater cleanup standards could be difficult. Therefore, this balancing criterion would be partially satisfied.

CAA 4 - Short-Term Effectiveness: CAA 4 would pose minimal risk to site workers. PPE and proper injection procedures would also minimize any potential risks to site workers during site activities. There are some potential short term environmental risks depending on the type of chemicals or bacteria (much of the time a combination of both) chosen for the in-situ remediation, but those are considered negligible. Short term risk to groundwater would be reduced quickly; however, some “bounce back” may occur. Therefore, this balancing criterion would be partially satisfied.

CAA 4 – Implementability: CAA 4 would be relatively hard to implement. Performing benchscale pilot studies to determine the appropriate chemicals or bacterium to inject can be burdensome. The effectiveness and reliability of in-situ treatment varies based on the heterogeneity of soil and fractures within the bedrock and the effectiveness of delivering the injected material to the targeted media. The design, testing, and implementation of the in-situ injection would require 18 to 24 months to complete; however, it takes 6 months to one year to receive an underground injection control (UIC) permit in Alabama. If additional injection events were required, the estimated time would increase. Therefore, this balancing criterion would be partially satisfied.

CAA 4 – Cost: The capital costs for implementing this alternative include benchscale treatment studies, cost of injected material, cost for UIC permit, cost of delivering injected material to targeted media, and confirmatory sampling of media. Confirmatory sampling, long term groundwater monitoring and LUCP preparation costs would also be incurred for this alternative. The estimated 30-year present cost for CAA 4 is approximately $680,000.

Table 7-3. Detailed Analysis of Alternatives – Evaluation Summary and Scoring
CAA 4 — Land Use Controls + In-Situ Soil Source Area Treatment + In-Situ Groundwater Treatment + Groundwater Monitoring

EVALUATION CRITERIA	SPECIFIC CRITERIA FACTOR CONSIDERATIONS	SCORE	
Long-Term Reliability and Effectiveness	How capable is the alternative in providing mitigation or reduction of the severity of the source(s) of potential risk?	5	
	How capable is the alternative in providing long-term protection for receptors through containment systems?	2	
	How capable is the alternative in providing long-term protection for receptors through institutional controls?	5	
			4.0
Reduction of Toxicity, Mobility, or Volume of Waste	How much does the alternative reduce the toxicity of the waste?	3	
	How much does the alternative reduce the mobility of the waste?	2	
	How much does the alternative reduce the volume of the waste?	5	
			3.3
Short-Term Effectiveness	How capable is the alternative at providing short-term effectiveness to address the risk to the community?	5	
	How capable is the alternative at providing short-term effectiveness to address the risk to the workers?	5	
	How capable is the alternative at providing short-term effectiveness to address the risk to the ecological receptors?	5	
			5.0
Implementability	What is the level of difficulty to find adequate TSD services, supplies, and/or equipment?	5	
	What is the level of difficulty to implement, operate, and maintain the chosen technology?	5	
	What is the level of difficulty to implement and maintain the chosen administrative components?	5	
	What is the level of difficulty to implement the alternative in a short time?	5	
			5.0
Cost	Are costs less than $100,000?	0	
	Are costs less than $250,000?	0	
	Are costs less than $500,000?	0	
	Are costs less than $1,000,000?	5	
	Are costs less than $2,000,000?	5	**2.0**
		Total	**19.3**

7.3.2 Balancing Criteria for CAA 5 — Land Use Controls + In-Situ Soil Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring

CAA 5 - Long–Term Reliability and Effectiveness: The hydraulic control and treatment of groundwater in AOC D provides a reliable and long-term corrective measure. The implementation of this alternative would minimize the primary concerns associated with this site. This type of remediation is widely used and is effective and reliable. The estimated useful life of this remediation would be greater than 30 years. Therefore, CAA 5 satisfies this balancing criterion.

CAA 5 - Reduction of Toxicity, Mobility, or Volume of Wastes: CAA 5 effectively reduces the toxicity, mobility, and volume by remediation of contaminated soil in the source areas and groundwater. Therefore, this balancing criterion would be satisfied.

CAA 5 - Short-Term Effectiveness: CAA 5 would pose minimal risk to site workers and the environment by using PPE and proper construction methods such as dust control techniques. The hydraulic control and treatment of groundwater would pose minimal risk to site workers and the environment since the water will be used in the plant process and eventually be treated in the Biological Treatment Facility. The implementation of this alternative would not result in risk to the community. Therefore, this balancing criterion would be satisfied.

CAA 5 – Implementability: CAA 5 would be relatively easily implemented. The necessary equipment, materials, and services for excavation and transport would be readily available. The completion of this alternative would accomplish the corrective measure objectives. The necessary equipment, materials, and services for groundwater hydraulic control are readily available and already installed at the site as part of the Interim Measures for this portion of the facility. Therefore this alternative is, in effect, already being implemented. Therefore, this balancing criterion would be satisfied.

CAA 5 – Cost: The capital costs would include installation of hydraulic control wells, installation of pumps and piping which has already been completed. Additional costs would include benchscale treatment studies, cost of injected material, cost for UIC permit, cost of delivering injected material to targeted media, confirmatory sampling of media, the preparation of a LUCP, and long term groundwater monitoring. The estimated 30-year present cost for CAA 5 is approximately $600,000.

Table 7-3. Detailed Analysis of Alternatives – Evaluation Summary and Scoring
CAA 5 — Land Use Controls + In-Situ Soil Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring

EVALUATION CRITERIA	SPECIFIC CRITERIA FACTOR CONSIDERATIONS	SCORE	
Long-Term Reliability and Effectiveness	How capable is the alternative in providing mitigation or reduction of the severity of the source(s) of potential risk?	5	
	How capable is the alternative in providing long-term protection for receptors through containment systems?	5	
	How capable is the alternative in providing long-term protection for receptors through institutional controls?	5	
			5.0
Reduction of Toxicity, Mobility, or Volume of Waste	How much does the alternative reduce the toxicity of the waste?	3	
	How much does the alternative reduce the mobility of the waste?	5	
	How much does the alternative reduce the volume of the waste?	5	
			4.3
Short-Term Effectiveness	How capable is the alternative at providing short-term effectiveness to address the risk to the community?	5	
	How capable is the alternative at providing short-term effectiveness to address the risk to the workers?	5	
	How capable is the alternative at providing short-term effectiveness to address the risk to the ecological receptors?	5	
			5.0
Implementability	What is the level of difficulty to find adequate TSD services, supplies, and/or equipment?	5	
	What is the level of difficulty to implement, operate, and maintain the chosen technology?	5	
	What is the level of difficulty to implement and maintain the chosen administrative components?	5	
	What is the level of difficulty to implement the alternative in a short time?	5	
			5.0
Cost	Are costs less than $100,000?	0	
	Are costs less than $250,000?	0	
	Are costs less than $500,000?	0	
	Are costs less than $1,000,000?	5	
	Are costs less than $2,000,000?	5	**2.0**
		Total	**21.3**

8.0 JUSTIFICATION AND RECOMMENDATION OF THE CORRECTIVE MEASURES

8.1 Remedy Selection

The foregoing analyses result in the following conclusions:

- COCs exceeded an ELCR of 10-6 and an HI of 0.1 in soil and groundwater.
- For the construction worker scenario and industrial worker scenario, the cumulative risk across all media is greater than an ELCR of 10-4 and an HI of 1.0.
- For the construction worker scenario and industrial worker scenario, the cumulative risk for subsurface soil exceeds an HI of 1.0, and several constituents exceed an HQ of 0.1 for a construction worker setting.
- A comparison of soil COC concentrations for leachability to soil factors indicate certain exceedances of GWP SSLs in subsurface soils.
- The soil contamination is deemed not to warrant corrective action based on the risk to human health; however, some areas where soil COCs exceed the GWP SSLs are recommended for remediation.
- Active groundwater remediation is also recommended.

Based on these conclusions and a detailed analysis that was performed individually and collectively with respect to the five alternatives, Alternative 5 - Land Use Controls + In-Situ Soil Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring is recommended as the corrective action alternative for SMA 4.

As presented in Section 5.2, the land use controls will include the preparation of a LUCP according to USEPA Region 4 guidance. The purpose of the LUCP is

- To ensure that the groundwater is not used before remediation is complete.
- To ensure that exposure to contaminated soil is mitigated during any future construction projects.
- To ensure that the land use remains industrial/commercial, a scenario that does not pose unacceptable risk based on detected soil concentrations.

The LUCP will also add a layer of protection beyond that needed to address the level of soil contamination identified in the risk assessment. The LUCP will also be:

- consistent with land use controls necessary to deal with contamination above cleanup standards at the other 4 SMAs.
- protective of higher levels of contamination, if any, that may not have been detected by sampling within SMA 5.

- conservative and protective down to one magnitude below the recommended cancer risk level.

The LUCP would identify the objective of the controls to restrict activities within the SMA 5 boundary, list the actions necessary to achieve the objective, and provide notice to onsite individuals of the contaminants at the site. The current and future industrial/commercial worker scenario is actually a very short term "construction-like" worker due to the asphalt, concrete and mineral wool covering SMA 4. It is recommended that the LUCP included, at a minimum, the following controls:

- A description of the land along with the certified land survey location of the boundary with respect to state plane coordinates,
- Placing a deed restriction on the property to limit the site to Industrial/Commercial Land Use.
- An explanation of the land use control including permits to perform any digging activities and the proper personal protective equipment (PPE) that must be used to protect workers, and the use of a fence and signs as necessary to prevent unauthorized access,
- Identification of the facility program point-of-contact designated responsible for implementing the LUCP,
- An on-site compliance monitoring program,
- Notification procedures to USEPA and ADEM whenever the facility anticipates a major change in land use,
- An annual field inspection and report submitted to USEPA and ADEM to document the effectiveness of the land use controls,
- A certification of the annual report by the designated official to continue compliance with the LUCP,
- A procedure to notify USEPA and ADEM immediately upon discovery of any unauthorized major change in land use or any activity inconsistent with the LUCP and the actions that would be implemented to ensure protectiveness, and
- A procedure to provide advance notification to EPA and ADEM of impending transfer, by sale or lease, of SMA 5.

Soil source areas will be remediated as needed to achieve cleanup standards based on the GWP SSL and the PCSs using in-situ treatment. This will help to prevent any further release of contaminants from the soil to the groundwater and will aid in advancing the groundwater remediation.

The types of biological and chemical in-situ soil source area treatments that will be considered during the Corrective Measures Implementation (CMI) Phase are:

- Sodium sulfite, yeast extract, calcium propionate, nutrient, and micronutrients
- Zero Valent Iron

- Potassium Permanganate
- Hydrogen Peroxide
- Hydrogen Release Compound
- Oxygen Release Compound
- Other Proprietary Chemicals

Groundwater removal and treatment will be conducted on the VOC plume located in SMA 4. Groundwater hydraulic control wells are currently installed in SMA 4 in order to recover contaminated groundwater from AOC D and to control the entire groundwater plume. The hydraulic control well network will continue to be evaluated to ensure that the entire plume shown in Figure 3-1 is controlled. The recovered groundwater is pumped and used as process water which eventually goes into the equalization tanks and is then sent to the ERP Coke Biological Treatment Facility (BTF) for subsequent discharge in compliance with ERP Coke's Clean Water Act NPDES permit.

In addition, long-term groundwater monitoring will occur to assess the effectiveness of the remediation system.

The combination of these alternatives will be the most effective, efficient and economical method to meet the corrective action objectives for SMA 4 and provide long-term protection of human health and the environment.

8.2 Post-Remedy Selection

After EPA issues its Response to Comments (RTC) and Final Decision document selecting the remedy, a Corrective Measures Implementation (CMI) Plan will be needed. The CMI plan will include the following, at a minimum:

a. A description of the conceptual design, technical features (e.g., plans and specifications, including any treatability studies) and a construction plan for the selected remedy(ies);
b. A proposed schedule that takes into account all phases of the CMI. The schedule should also include the submittal of documents to support the CMI; and
c. Requirements for removal and decontamination of units, equipment, devices, and structures that will be used to implement the remedy(ies).

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Table 3-1
SMA 4 - Surface Soil 0-1 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, Alabama

CAS No.	Chemical Name	SBB001 0 - 1 ft	SBB002 0 - 1 ft	SBB003 0 - 1 ft	SBB004 0 - 1 ft	SBB005 0 - 1 ft	SBB006 0 - 1 ft	SBB007 0 - 1 ft	SBB008 0 - 1 ft	SBB009 0 - 1 ft	SBB010 0 - 1 ft	Number of Samples	Detections	Concentration Min	Concentration Max	Screening Values - RSLs Industrial	Screening Values - RSLs SSL	COPC? Industrial
VOLATILE ORGANIC CHEMICALS (mg/kg)																		
67-66-3	Chloroform	0.00051 u	0.00048 u	0.00038 u	0.00039 u	0.00044 u	0.00054 u	**0.0078 j**	**0.007 j**	0.00034 u	0.00035 u	10	2	0.00034 u	0.0078	1.4	0.0015	No [2]
SEMIVOLATILE ORGANIC CHEMICALS (mg/kg)																		
120-82-1	1,2,4-Trichlorobenzene	0.400 u	0.420 u	0.035 u	0.040 u	**0.4100 j**	**0.170 j**	0.0340 u	**0.059 j**	0.033 u	0.037 u	10	3	0.042 u	0.420	26	5.3	No [2]
106-46-7	1,4-Dichlorobenzene	0.190 u	0.200 u	0.017 u	0.019 u	**0.0520 j**	**0.051 j**	0.0170 u	0.024 u	0.016 u	0.018 u	10	2	0.016 u	0.052	11	3.58	No [2]
98-86-2	Acetophenone	0.280 u	0.300 u	0.025 u	0.028 u	**0.1200 j**	**0.150 j**	0.025 u	0.036 u	0.023 u	**0.042 j**	10	3	0.042	0.150	12000	32	No [2]
117-81-7	bis(2-Ethylhexyl)phthalate	0.650 u	0.680 u	0.058 u	**0.088 j**	**1**	**1.70**	0.0570 u	**0.094 j**	0.054 u	**0.5**	10	5	0.054 u	1.700	160	100	No [2]
85-68-7	Butyl benzyl phthalate	0.610 u	0.640 u	0.054 u	0.061 u	0.061 u	**0.077 j**	0.0530 u	0.077 u	0.051 u	**0.110 j**	10	2	0.051 u	0.110	1200	0.15	No [2]
86-74-8	Carbazole	0.510 u	0.530 u	0.046 u	0.051 u	**0.130 j**	**0.170 j**	0.0440 u	0.065 u	0.042 u	**0.061 j**	10	3	0.042 u	0.170	nd	0.1	**Yes** [3]
132-64-9	Dibenzofuran	0.280 u	**0.410 j**	**0.028 j**	**0.036 j**	**0.310 j**	**0.400 j**	0.025 u	**0.056 j**	0.023 u	**0.120 j**	10	7	0.023 u	0.410	100	nd	No [2]
85-01-8	Phenanthrene[1]	**2**	**4.30**	**0.140**	**0.240**	**1.300**	**8.900**	**0.590**	**0.018 j**	**0.520**	**0.940**	10	10	0.018	8.90	2300	nd	No [2]
129-00-0	Pyrene	**2.9**	**7**	**0.067**	**0.220**	**0.650**	**3.800**	**0.550**	**0.023 j**	**0.980**	**0.440**	10	10	0.023	7	2300	7700	No [2]
91-57-6	2-Methylnaphthalene	**1.300**	**2.900**	**0.150**	**0.120**	**1.100**	**7.100**	**0.011 j**	**0.0096 j**	**0.055 j**	**0.880**	10	10	0.0096	7.100	300	45	No [2]
83-32-9	Acenaphthene	**0.190**	**0.380**	**0.0076**	**0.012**	**0.064**	**0.430**	**0.024 j**	0.002 u	**0.019 j**	**0.039**	10	9	0.002 u	0.430	4500	1400	No [2]
208-96-8	Acenaphthylene[1]	**0.800**	**1.600**	**0.013**	**0.036**	**0.073**	**0.260**	**0.011 j**	**0.0089 j**	**0.25**	**0.066**	10	10	0.0089	1.600	2300	nd	No [2]
120-12-7	Anthracene	**0.780**	**1.700**	**0.025**	**0.067**	**0.280**	**2**	**0.088**	0.009 u	**0.220**	**0.190**	10	9	0.009 u	2	23000	23000	No [2]
56-55-3	Benz(a)anthracene	**2.70**	**6.60**	**0.050**	**0.160**	**0.410**	**2.20**	**0.230**	**0.016 j**	**0.720**	**0.310**	10	10	0.02	6.60	2.9	1	**Yes** [4]
50-32-8	Benzo(a)pyrene	**3.4**	**7.70**	**0.045**	**0.150**	**0.280**	**1.30**	**0.180**	**0.018 j**	**0.620**	**0.210**	10	10	0.02	7.70	0.29	16	**Yes** [4]
205-99-2	Benzo(b)fluoranthene	**5.2**	**13**	**0.090**	**0.210**	**0.5**	**2.70**	**0.270**	**0.028 j**	**0.900**	**0.470**	10	10	0.0280	13	2.9	2	**Yes** [4]
191-24-2	Benzo(g,h,i)perylene[1]	**2.5**	**4.90**	**0.038**	**0.110**	**0.23**	**1.20**	**0.130**	0.014 u	**0.400**	**0.200**	10	9	0.014 u	4.90	2300	nd	No [2]
207-08-9	Benzo(k)fluoranthene	**2**	**4.90**	**0.022**	**0.075**	**0.16**	**0.80**	**0.088**	0.013 u	**0.340**	**0.140**	10	9	0.013 u	4.90	29	23	No [2]
218-01-9	Chrysene	**3.9**	**9.40**	**0.110**	**0.220**	**0.81**	**5.10**	**0.270**	**0.021 j**	**0.690**	**0.640**	10	10	0.021	9.40	290	69	**Yes** [5]
53-70-3	Dibenz(a,h)anthracene	**0.89**	**2.10**	**0.013**	**0.035**	**0.10**	**0.49**	**0.026 j**	0.016 u	**0.120**	**0.073**	10	9	0.013	2.10	0.29	1	**Yes** [4]
206-44-0	Fluoranthene	**3.70**	**8.5**	**0.095**	**0.240**	**0.690**	**4.100**	**0.710**	**0.028 j**	**1.400**	**0.540**	10	10	0.0280	8.5	3000	11000.00	No [2]
86-73-7	Fluorene	**0.27**	**0.58**	**0.015**	**0.019**	**0.200**	**1.900**	**0.021 j**	0.0059 u	**0.057 j**	**0.084**	10	9	0.0059 u	1.90	3000	1700	No [2]
193-39-5	Indeno(1,2,3-cd)pyrene	**2.9**	**6.30**	**0.038**	**0.100**	**0.220**	**1.100**	**0.130**	**0.019 j**	**0.470**	**0.190**	10	10	0.0190	6.30	2.9	8	**Yes** [5]
91-20-3	Naphthalene	**1.5**	**3.30**	**0.140**	**0.140**	**0.870**	**5.800**	**0.02 j**	**0.017 j**	**0.340**	**0.680**	10	10	0.0170	5.80	17	0.026	No [2]
INORGANIC CHEMICALS (mg/kg)																		
7429-90-5	Aluminum	**8500**	**8400**	**13000**	**9900**	**11000**	**16000**	**49000**	**24000**	**7000**	**9400**	10	10	7000	49000	110000	1000000	No [2]
7440-38-2	Arsenic	**18**	**23**	**25**	**15**	**6.70**	**11**	**8.80**	**26**	**13**	**13**	10	10	6.70	26	3	6	**Yes** [4]
7440-39-3	Barium	**97**	**120**	**78**	**120**	**160**	**210**	**420**	**150**	**89**	**160**	10	10	78	420	22000	1800	No [2]
7440-41-7	Beryllium	**1.300**	**1.400**	**1.900**	**1.100**	**2**	**2.60**	**8.30**	**2.900**	**0.970**	**1.400**	10	10	0.97	8.30	230	700	No [2]
7440-43-9	Cadmium	**0.390 j**	**0.560 j**	0.110 u	0.120 u	**0.330 j**	**0.590 j**	**0.290 j**	**0.920**	**0.230 j**	**0.720**	10	8	0.11 u	0.92	98	40	No [2]
7440-70-2	Calcium	**6900**	**5600**	**3000**	**13000**	**95000**	**100000**	**220000**	**58000**	**230000**	**110000**	10	10	3000	230000	nd	nd	No [7]
7440-47-3	Chromium	**33**	**33**	**68**	**38**	**33**	**41**	**48**	**62**	**22**	**44**	10	10	22	68	6.3	36	**Yes** [4]
7440-48-4	Cobalt	**11**	**8.10**	**18**	**16**	**4.80**	**5.30**	**4.5**	**15**	**9.10**	**9.20**	10	10	4.5	18	35	nd	No [2]
7440-50-8	Copper	**31**	**53**	**65**	**17**	**30**	**45**	**9.90**	**54**	**14**	**46**	10	10	9.90	65	4700	920	No [2]
	Iron (Ferric)	**25000**	**23000**	**54000**	**26000**	**14000**	**14000**	**17000**	**38000**	**20000**	**22000**	10	10	14000	54000			No [6]
7439-92-1	Lead	**67**	**200**	**50**	**32**	**31**	**48**	**15**	**140**	**26**	**51**	10	10	15	200	800	550	No [2]
7439-95-4	Magnesium	**2200**	**1400**	**830**	**3700**	**23000**	**20000**	**52000**	**8500**	**16000**	**14000**	10	10	830	52000	nd	nd	No [7]
7439-96-5	Manganese	**810**	**320**	**1500**	**940**	**870**	**930**	**2500**	**860**	**990**	**1200**	10	10	320	2500	2600	1100	No [2]
7439-97-6	Mercury	**0.47**	**0.80**	**0.0970**	**0.0520**	**0.059**	**0.095**	0.0091 u	**0.490**	**0.046**	**0.0780**	10	9	0.0091 u	0.800	4.6	6	No [2]
7440-02-0	Nickel	**14**	**18**	**12**	**14**	**13**	**16**	**7**	**22**	**10**	**15**	10	10	7	22	2200	4000	No [2]
7440-09-7	Potassium	**920**	**810**	**670**	**740**	**1700**	**2600**	**6000**	**4500**	**1600**	**1200**	10	10	670	6000	nd	nd	No [7]

Table 3-1
SMA 4 - Surface Soil 0-1 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, Alabama

CAS No.	Chemical Name	SBB001 0 - 1 ft	SBB002 0 - 1 ft	SBB003 0 - 1 ft	SBB004 0 - 1 ft	SBB005 0 - 1 ft	SBB006 0 - 1 ft	SBB007 0 - 1 ft	SBB008 0 - 1 ft	SBB009 0 - 1 ft	SBB010 0 - 1 ft	Number of Samples	Number of Detections	Concentration Min	Concentration Max	Screening Values - RSLs Industrial	Screening Values - RSLs SSL	COPC? Industrial
7782-49-2	Selenium	**1.900 j**	**1.300 j**	1 u	**1.30 j**	**2.10 j**	**4**	**2.20 j**	**11**	**1.10 j**	**1.60 j**	10	9	1 u	11	580	3.5	No [2]
7440-22-4	Silver	**0.280 j**	**0.570 j**	0.0640 u	0.0730 u	**0.110 j**	**0.120 j**	**0.130 j**	**0.190 j**	0.0670 u	**0.1300 j**	10	7	0.064 u	0.570	580	110	No [2]
7440-62-2	Vanadium	**37**	**30**	**69**	**42**	**23**	**29**	**40**	**47**	**22**	**30**	10	10	22	69	580	5200	No [2]
7440-66-6	Zinc	**390**	**410**	**140**	**470**	**160**	**300**	**31**	**500**	**160**	**240**	10	10	31	500	35000	28640	No [2]

BOLDED concentrations represent detected results.
RSL = USEPA's Regional Screening Levels (USEPA, Nov. 2015)
SSL = Site-specific soil screening levels presented in Appendix G of the Phase III RCRA Facility Investigation Report dated March 2009, prepared by Arcadis and CH2MHill.
1 = No published RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate.
2 = chemical eliminated as a COPC as the maximum detected concentration does not exceed the RSL
3 = chemical conservatively retained as a COPC because no published screening value is available
4 = chemical retained as a COPC as the maximum detected concentration exceeds the RSL
5 = chemical retained as a COPC because it is included in the group of potentially carcinogenic PAHs and at least one in that group has exceeded its screening level
6 = chemical eliminated as it is measured as a species, rather than the 'total' content
7 = chemical eliminated as it is considered to be a nutritional element
nd = no data
u = not detected
j = estimated
b = chemical detected in the sample and blank

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0001 (2-4 ft) 14-Jan-08	CM-SB0002 (10-12 ft) 14-Jan-08	CM-SB0002 (2-4 ft) 14-Jan-08	CM-SB0002 (6-8 ft) 14-Jan-08	CM-SB0003 (2-4 ft) 14-Jan-08	CM-SB0003 (5-7 ft) 14-Jan-08	CM-SB0003 (8-10 ft) 14-Jan-08	CM-SB0004 (12-14 ft) 14-Jan-08	CM-SB0004 (2-4 ft) 14-Jan-08	CM-SB0004 (6-8 ft) 14-Jan-08	CM-SB0005 (2-4 ft) 15-Jan-08	CM-SB0005 (6-8 ft) 15-Jan-08	CM-SB0006 (12-14 ft) 15-Jan-08	CM-SB0006 (3-5 ft) 15-Jan-08	CM-SB0006 (7-9 ft) 15-Jan-08	CM-SB0007 (2-4 ft) 15-Jan-08	CM-SB0008 (2-4) ft 15-Jan-08	CM-SB0008 (5-7 ft) 16-Jan-08	CM-SB0009 (2-4 ft) 16-Jan-08	CM-SB0009 (8-10 ft) 16-Jan-08	CM-SB0010 (12-14 ft) 15-Jan-08	CM-SB0010 (5-7 ft) 15-Jan-08
VOLATILE ORGANICS (mg/kg)																							
79005	1,1,2-Trichloroethane	0.0021 UJ	0.0013 U	0.097 U	0.001 U	0.00086 U	0.048 U	0.075 U	0.001 U	0.0011 U	0.0009 U	1.2 U	0.056 U	0.053 U	7.4 U	0.057 U	0.15 U	0.3 U	0.064 U	0.11 U	0.0011 U	0.06 U	0.31 U
120821	1,2,4-Trichlorobenzene											0.049 U	0.053 U	0.049 U	0.056 U	0.052 U	0.053 U	0.053 U	0.057 U	0.057 U	0.055 U	0.056 U	0.053 U
107062	1,2-Dichloroethane	0.0035 UJ	0.0022 U	0.16 U	0.0017 U	0.0014 U	0.08 U	0.12 U	0.0017 U	0.0019 U	0.0015 U	1.9 U	0.094 U	0.088 U	12 U	0.094 U	0.25 U	0.5 U	0.11 U	0.18 U	0.0019 U	0.1 U	0.52 U
78875	1,2-Dichloropropane	0.0021 UJ	0.0013 U	0.097 U	0.001 U	0.00086 U	0.048 U	0.075 U	0.001 U	0.0011 U	0.0009 U	1.2 U	0.056 U	0.053 U	7.4 U	0.057 U	0.15 U	0.3 U	0.064 U	0.11 U	0.0011 U	0.06 U	0.31 U
106467	1,4-Dichlorobenzene											0.041 U	0.044 U	0.041 U	0.046 U	0.043 U	0.044 U	0.044 U	0.048 U	0.048 U	0.046 U	0.047 U	0.044 U
78933	2-Butanone (MEK)	0.019 UJ	0.012 U	0.89 U	0.0092 U	0.0079 U	0.44 U	0.68 U	0.0093 U	0.01 U	0.0082 U	11 U	0.52 U	0.49 U	68 U	0.52 U	1.4 U	2.7 U	0.59 U	0.97 U	0.01 U	0.55 U	2.9 U
67641	Acetone	**0.056 J**	**0.0087 J**	0.41 UJ	**0.017 J**	0.0037 U	0.2 UJ	0.32 U	**0.043 =**	**0.011 J**	**0.015 J**	4.9 U	0.24 U	0.22 U	32 U	0.24 U	0.63 U	**1.2 J**	0.27 U	0.45 U	**0.012 J**	**0.62 J**	**2 J**
71432	Benzene	**0.014 J**	0.0012 U	**0.97 J**	**0.058 =**	**0.0025 J**	**9.4 J**	**1.4 =**	**0.0015 J**	**0.15 =**	**0.093 J**	**21 =**	**0.46 =**	**11 =**	**400 =**	**5.7 =**	**32 =**	**5.4 =**	**1.7 =**	**11 =**	**0.0016 J**	**1.5 =**	**0.75 J**
75150	Carbon disulfide	**0.0059 J**	0.00084 U	0.063 U	**0.0013 J**	0.00056 U	0.031 U	0.049 U	0.00066 U	**0.012 =**	**0.012 =**	0.76 U	0.037 U	0.034 U	4.8 U	0.037 U	0.097 U	0.19 U	0.042 U	0.068 U	**0.0027 J**	0.039 U	0.2 U
56235	Carbon tetrachloride	0.0025 UJ	0.0015 UJ	0.11 U	0.0012 UJ	0.001 UJ	0.056 U	0.087 U	0.0012 U	0.0013 U	0.001 U	1.4 U	0.066 U	0.062 U	8.7 U	0.066 U	0.17 U	0.35 U	0.075 U	0.12 U	0.0013 U	0.07 U	0.37 U
108907	Chlorobenzene	0.0019 UJ	0.0012 UJ	**0.091 J**	0.00092 UJ	0.00079 UJ	0.044 UJ	0.068 U	**0.002 J**	**0.012 =**	**0.01 J**	**300 =**	**3.7 =**	**5.3 =**	**190 =**	**11 =**	**1.7 =**	**89 =**	**35 =**	0.097 U	**0.002 J**	**36 =**	**92 =**
75003	Chloroethane	0.0027 UJ	0.0016 U	0.12 U	0.0013 U	0.0011 U	0.06 U	0.093 U	0.0013 U	0.0014 U	0.0011 U	1.5 U	0.07 U	0.066 U	9.3 U	0.071 U	0.19 U	0.37 U	0.08 U	0.13 U	0.0014 U	0.075 U	0.39 U
67663	Chloroform	0.0015 UJ	0.00089 UJ	0.067 UJ	0.00068 UJ	0.00059 UJ	0.033 UJ	0.051 U	0.0007 U	0.00077 U	0.00061 U	0.79 U	0.038 U	0.036 U	5.1 U	0.039 U	0.1 U	0.2 U	0.044 U	0.072 U	0.00078 U	0.041 U	0.21 U
156592	cis-1,2-Dichloroethene	0.0017 UJ	0.001 U	0.078 U	0.0008 U	0.00069 U	0.039 U	0.06 U	0.00082 U	0.0009 U	0.00072 U	0.93 U	0.045 U	0.042 U	6 U	0.045 U	0.12 U	0.24 U	**0.35 =**	0.084 U	0.00091 U	0.048 U	0.25 U
1006101	cis-1,3-Dichloropropene	0.0018 UJ	0.0011 U	0.081 U	0.00083 U	0.00072 U	0.04 U	0.062 U	0.00085 U	0.00093 U	0.00075 U	0.97 U	0.047 U	0.044 U	6.2 U	0.047 U	0.12 U	0.25 U	0.054 U	0.088 U	0.00095 U	0.05 U	0.26 U
100414	Ethylbenzene	0.0032 UJ	0.0019 U	**0.34 J**	0.0015 U	0.0013 U	0.072 U	0.11 U	0.0015 U	0.0017 U	0.0013 U	1.7 U	0.085 U	0.079 U	**33 =**	0.085 U	**1.2 =**	**7.5 =**	**0.4 =**	0.16 U	0.0017 U	0.09 U	**2 =**
108383/	m- and p-Xylenes	0.0013 UJ	0.0008 U	**1.8 =**	0.00062 UB	0.00053 U	0.03 UB	**0.19 J**	0.00063 U	0.00069 UB	0.00055 UB	**11 =**	0.035 U	0.033 U	**120 =**	**0.042 J**	**2.5 =**	**68 =**	**0.8 =**	**0.41 J**	0.0007 U	**0.14 J**	**7 =**
75092	Methylene chloride	0.0028 UJ	0.0017 UB	0.13 U	0.0013 UB	0.0011 U	0.064 U	0.1 U	0.0014 U	0.0015 U	0.0012 U	1.6 U	0.075 U	0.071 U	9.9 U	0.075 U	**0.22 J**	0.4 U	0.086 U	0.14 U	0.0015 U	0.08 U	0.42 U
95476	o-Xylene	0.0011 UJ	0.00065 U	**0.28 J**	0.0005 U	0.00043 U	0.024 U	**0.055 J**	0.00051 U	0.00056 UB	0.00045 U	0.58 U	0.028 U	0.026 U	**38 =**	0.028 U	**0.71 =**	**18 =**	0.032 U	**0.39 J**	0.00057 U	**0.12 J**	**11 =**
100425	Styrene	0.0011 UJ	0.00066 UJ	0.05 UJ	0.00051 UJ	0.00044 UJ	0.024 UJ	0.038 U	0.00052 U	0.00057 U	0.00046 U	0.59 U	0.029 U	0.027 U	3.8 U	0.029 U	0.076 U	0.15 U	0.033 U	0.054 U	0.00058 U	0.031 U	0.16 U
127184	Tetrachloroethene	0.0016 UJ	0.00097 UJ	0.073 UJ	0.00075 UJ	0.00065 UJ	0.036 UJ	0.056 U	0.00076 U	0.00084 U	0.00067 U	0.87 U	0.042 U	0.04 U	5.6 U	0.042 U	0.11 U	**2 =**	**0.66 =**	0.079 U	0.00086 U	0.045 U	0.23 U
108883	Toluene	**1.7** =	0.0011 U	**4.1 =**	**0.0022 J**	0.00072 U	**0.27 =**	**0.37 =**	**0.0019 J**	**0.0086 =**	**0.0031 J**	**17 =**	0.047 U	**1.7 =**	**15000 =**	**2.1 =**	**5.1 =**	**60 =**	**0.31 =**	**5.8 =**	**0.0053 =**	**1.8 =**	**4.8 =**
156605	trans-1,2-Dichloroethene	0.0018 UJ	0.0011 U	0.08 U	0.00083 U	0.00071 U	0.04 U	0.062 U	0.00084 U	0.00093 U	0.00074 U	0.96 U	0.046 U	0.044 U	6.1 U	0.047 U	0.12 U	0.25 U	0.053 U	0.087 U	0.00094 U	0.05 U	0.26 U
1006102	trans-1,3-Dichloropropene	0.0017 UJ	0.001 U	0.079 U	0.00081 U	0.0007 U	0.039 U	0.06 U	0.00082 U	0.00091 U	0.00073 U	0.94 U	0.046 U	0.043 U	6 U	0.046 U	0.12 U	0.24 U	0.052 U	0.085 U	0.00092 U	0.049 U	0.25 U
79016	Trichloroethene	0.0016 UJ	0.00097 UJ	0.073 UJ	0.00075 UJ	0.00065 UJ	0.036 UJ	0.056 U	0.00076 U	0.00084 U	0.00067 U	0.87 U	0.042 U	0.04 U	5.6 U	0.042 U	0.11 U	0.22 U	**0.32 =**	0.079 U	0.00086 U	0.045 U	0.23 U
75014	Vinyl chloride	0.0028 UJ	0.0017 U	0.13 U	0.0013 U	0.0011 U	0.064 U	0.1 U	0.0014 U	0.0015 U	0.0012 U	1.6 U	0.075 U	0.071 U	9.9 U	0.075 U	0.2 U	0.4 U	0.086 U	0.14 UJ	0.0015 U	0.08 U	0.42 U
1330207	Xylenes	0.0023 UJ	0.0014 U	**2.1** =	0.0011 U	0.00093 U	**0.07 J**	**0.25 J**	0.0011 U	0.0012 UB	0.00097 UB	**11 =**	0.061 U	0.057 U	**160 =**	0.061 U	**3.2 =**	**86 =**	**0.82 =**	**0.8 J**	0.0012 U	**0.26 J**	**18 =**
SEMIVOLATILE ORGANICS (mg/kg)																							
90120	1-Methylnaphthalene											**0.13 J**	0.046 U	0.042 U	**5.4 =**	0.044 U	0.045 U	**0.084 J**	0.049 U	**0.16 J**	0.047 U	0.048 U	0.045 U
95578	2-Chlorophenol											0.049 U	0.053 U	0.049 U	0.056 U	0.052 U	0.053 U	**0.33 J**	0.057 U	0.057 U	0.055 U	0.056 U	**0.12 J**
91576	2-Methylnaphthalene											**0.19 J**	0.046 U	0.042 U	**12 =**	0.044 U	0.045 U	**0.18 J**	0.049 U	**0.26 J**	0.047 U	0.048 U	0.045 U
95487	2-Methylphenol (o-cresol)											0.048 U	0.052 U	0.048 U	**5 =**	0.05 U	0.052 U	**0.44 =**	0.056 U	0.056 U	**0.087 J**	**0.11 J**	0.052 U
6579496	3 & 4 Methylphenol											0.049 U	0.053 U	0.049 U	**4 =**	0.052 U	0.053 U	**0.4 J**	0.057 U	0.057 U	**0.24 J**	**0.31 J**	0.053 U
106445	4-Methylphenol (p-cresol)																						
83329	Acenaphthene											0.042 U	0.046 U	0.042 U	**2.2 =**	0.044 U	0.045 U	0.045 U	0.049 U	**0.091 J**	0.047 U	0.048 U	0.045 U
208968	Acenaphthylene[2]											**0.11 J**	0.049 U	0.046 U	**0.46 =**	0.048 U	0.049 U	0.049 U	0.053 U	**0.06 J**	0.051 U	0.052 U	0.049 U
120127	Anthracene											**0.18 J**	0.062 U	0.057 U	**9.2 =**	0.06 U	0.062 U	**0.16 J**	0.067 U	**0.29 J**	0.065 U	0.065 U	0.062 U
56553	Benzo(a)anthracene											**0.96 =**	0.048 U	0.045 U	**12 =**	**0.082 J**	0.048 U	**0.61 =**	0.052 U	**0.89 =**	0.05 U	0.051 U	0.048 U
50328	Benzo(a)pyrene											**0.94 =**	0.046 U	0.042 U	**10 =**	0.044 U	0.045 U	**0.57 =**	0.049 U	**0.94 =**	0.047 U	0.048 U	0.045 U
205992	Benzo(b)fluoranthene											**1.7 =**	0.065 U	0.06 U	**14 =**	0.063 U	0.064 U	**0.93 =**	0.069 U	**1.6 =**	0.067 U	0.068 U	0.064 U
191242	Benzo(g,h,i)perylene[2]											**0.68 =**	0.049 U	0.046 U	**4.6 =**	0.048 U	0.049 U	**0.3 J**	0.053 U	**0.59 =**	0.051 U	0.052 U	0.049 U
207089	Benzo(k)fluoranthene											**0.5 =**	0.046 U	0.042 U	**4.2 =**	0.044 U	0.045 U	**0.32 J**	0.049 U	**0.49 =**	0.047 U	0.048 U	0.045 U
117817	Bis(2-ethylhexyl)phthalate											0.043 U	0.047 U	0.043 U	0.049 U	0.046 U	0.046 U	0.047 U	0.05 U	0.051 U	0.049 U	0.049 U	0.047 U
86748	Carbazole											**0.068 J**	0.047 U	0.043 U	**12 =**	0.046 U	0.046 U	0.047 U	0.05 U	**0.15 J**	0.049 U	0.049 U	0.047 U
218019	Chrysene											**0.97 =**	0.044 U	0.041 U	**10 =**	**0.084 J**	0.044 U	**0.56 =**	0.048 U	**0.95 =**	0.046 U	0.047 U	0.044 U
53703	Dibenzo(a,h)anthracene											**0.24 J**	0.044 U	0.041 U	**1.8 =**	0.043 U	0.044 U	0.044 U	0.048 U	**0.2 J**	0.046 U	0.047 U	0.044 U
132649	Dibenzofuran											**0.09 J**	0.063 U	0.059 U	**8.2 =**	0.062 U	0.063 U	**0.093 J**	0.068 U	**0.16 J**	0.066 U	0.067 U	0.063 U
84662	Diethylphthalate											0.046 U	0.049 U	**0.12 J**	0.052 U	0.048 U	**0.13 J**	**0.1 J**	**0.12 J**	0.053 U	0.051 U	0.052 U	**0.12 J**
206440	Fluoranthene											**1.9 =**	0.059 U	0.055 U	**33 =**	**0.18 J**	0.059 U	**1.3 =**	0.064 U	**1.8 =**	0.062 U	0.063 U	0.059 U
86737	Fluorene											**0.22 J**	0.061 U	0.056 U	**16 =**	0.059 U	0.06 U	**0.21 J**	0.065 U	**0.19 J**	0.063 U	0.064 U	0.061 U
193395	Indeno(1,2,3-cd)pyrene											**0.54 =**	0.046 U	0.042 U	**3.7 =**	0.044 U	0.045 U	**0.23 J**	0.049 U	**0.38 J**	0.047 U	0.048 U	0.045 U
91203	Naphthalene											**0.76 =**	0.046 U	0.042 U	**39 =**	0.044 U	**0.11 J**	**5.6 =**	0.049 U	**1.5 =**	0.047 U	0.048 U	0.045 U
85018	Phenanthrene[2]											**1 =**	0.057 U	0.053 U	**44 =**	**0.27 J**	0.057 U	**0.92 =**	0.061 U	**1 =**	0.059 U	0.06 U	0.057 U
108952	Phenol											**0.33 J**	0.046 U	0.042 U	**4.7 =**	0.044 U	**0.1 J**	**1.2 =**	0.049 U	**3.1 =**	**0.15 J**	**0.54 =**	**1.5 =**
129000	Pyrene											**1.5 =**	0.058 U	0.054 U	**21 =**	**0.14 J**	0.058 U	**0.94 =**	0.063 U	**2 =**	0.061 U	0.061 U	0.058 U

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0001 (2-4 ft) 14-Jan-08	CM-SB0002 (10-12 ft) 14-Jan-08	CM-SB0002 (2-4 ft) 14-Jan-08	CM-SB0002 (6-8 ft) 14-Jan-08	CM-SB0003 (2-4 ft) 14-Jan-08	CM-SB0003 (5-7 ft) 14-Jan-08	CM-SB0003 (8-10 ft) 14-Jan-08	CM-SB0004 (12-14 ft) 14-Jan-08	CM-SB0004 (2-4 ft) 14-Jan-08	CM-SB0004 (6-8 ft) 14-Jan-08	CM-SB0005 (2-4 ft) 15-Jan-08	CM-SB0005 (6-8 ft) 15-Jan-08	CM-SB0006 (12-14 ft) 15-Jan-08	CM-SB0006 (3-5 ft) 15-Jan-08	CM-SB0006 (7-9 ft) 15-Jan-08	CM-SB0007 (2-4 ft) 15-Jan-08	CM-SB0008 (2-4) ft 15-Jan-08	CM-SB0008 (5-7 ft) 15-Jan-08	CM-SB0009 (2-4 ft) 16-Jan-08	CM-SB0009 (8-10 ft) 16-Jan-08	CM-SB0010 (12-14 ft) 15-Jan-08	CM-SB0010 (5-7 ft) 15-Jan-08
INORGANICS (mg/kg)																							
7440360	Antimony, Total																						
7440382	Arsenic, Total																						
7440393	Barium, Total																						
7440417	Beryllium, Total																						
7440439	Cadmium, Total																						
7440473	Chromium, Total																						
7440508	Copper, Total																						
7439921	Lead, Total																						
7440020	Nickel, Total																						
7782492	Selenium, Total																						
7440280	Thallium, Total																						
7440666	Zinc, Total																						
57125	Cyanide, Total																						

U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
1 = USEPA, November 2015. Regional Screening Levels (RSLs).
2 = No published RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate concentration.
3 = chemical retained as a COPC because the maximum concentration exceeds the RSL
4 = chemical excluded as a COPC because the maximum concentration does not exceed the RSL
5 = chemical conservatively retained as a COPC because there is no published RSL
6 = chemical retained as a COPC because it is included in the group of potentially carcinogenic PAHs,
and at least one in that group has exceeded its screening level.
7 = Source: USEPA, November 2015, RSL table.

COPC = chemical of potential concern
SSL = groundwater protection soil screening level (Arcadis & CH2MHill, 2009)

U = qualifier co
J = qualifier cod
BOLD font indi
1 = USEPA, No
2 = No publishe
3 = chemical ret
4 = chemical ex
5 = chemical co
6 = chemical ret
and at least o
7 = Source: USI

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0010 (9-11 ft) 15-Jan-08	CM-SB0011 (10-12 ft) 16-Jan-08	CM-SB0011 (2-4 ft) 16-Jan-08	CM-SB0011 (6-8 ft) 16-Jan-08	CM-SB0012 (2-4 ft) 18-Jan-08	CM-SB0012 (8-10 ft) 18-Jan-08	CM-SB0013 (2-4 ft) 16-Jan-08	CM-SB0013 (6-8 ft) 16-Jan-08	CM-SB0015 (2-4 ft) 15-Jan-08	CM-SB0015 (6-8 ft) 15-Jan-08	CM-SB0015 (9-11 ft) 15-Jan-08	CM-SB0016 (2-4 f) 18-Jan-08	CM-SB0016 (4-6 ft) 18-Jan-08	CM-SB0017 (2-4) 16-Jan-08	CM-SB0017 (8-10 ft) 16-Jan-08	CM-SB0018 (2-4) 16-Jan-08	CM-SB0018 (7-9 ft) 16-Jan-08	CM-SB0019 (2-4 ft) 15-Jan-08	CM-SB0019 (6-8 ft) 15-Jan-08	CM-SB0019 (9-11 ft) 15-Jan-08	CM-SB0020 (2-4 ft) 18-Jan-08	CM-SB0020 (4-6 ft) 18-Jan-08
VOLATILE ORGANICS (mg/kg)																							
79005	1,1,2-Trichloroethane	0.056 U	0.062 U	0.3 U	0.0012 U	0.069 U	0.065 U	0.23 U	0.071 U	0.0015 UJ	0.13 U	0.057 U	0.06 UJ	0.0014 UJ	64 U	0.056 U	76 U	0.065 U	5.6 U	2.4 U	1.4 U	0.079 UJ	0.06 UJ
120821	1,2,4-Trichlorobenzene	0.054 U	0.055 U	0.31 U	0.055 U	0.059 U	0.056 U	0.051 U	0.057 U	0.051 U	0.056 U	0.054 U	0.048 U	0.056 U	0.054 U	0.054 U	0.058 U	0.058 U	0.05 U	0.055 U	0.059 U	0.057 U	0.053 U
107062	1,2-Dichloroethane	0.093 U	0.1 U	0.51 U	0.0019 U	0.11 U	0.11 U	0.39 U	0.12 U	0.0025 UJ	0.22 U	0.094 U	0.1 UJ	0.0023 UJ	110 U	0.094 U	130 U	0.11 U	9.3 U	4 U	2.3 U	0.13 UJ	0.1 UJ
78875	1,2-Dichloropropane	0.056 U	0.062 U	0.3 U	0.0012 U	0.069 U	0.065 U	0.23 U	0.071 U	0.0015 UJ	0.13 U	0.057 U	0.06 UJ	0.0014 UJ	64 U	0.056 U	76 U	0.065 U	5.6 U	2.4 U	1.4 U	0.079 UJ	0.06 UJ
106467	1,4-Dichlorobenzene	0.045 U	0.046 U	0.26 U	0.046 U	0.049 U	0.047 U	0.043 U	0.048 U	0.043 U	0.047 U	0.045 U	0.04 U	0.046 U	**0.29 J**	0.045 U	0.048 U	0.049 U	**0.18 J**	0.046 U	0.049 U	0.047 U	**0.31 J**
78933	2-Butanone (MEK)	0.51 U	0.57 U	2.8 U	0.011 U	0.63 U	0.6 U	2.1 U	0.65 U	0.013 UJ	1.2 U	0.52 U	0.55 UJ	0.013 UJ	580 U	0.52 U	700 U	0.6 U	51 U	22 U	13 U	0.73 UJ	0.55 UJ
67641	Acetone	0.24 U	0.27 U	1.3 U	**0.016 J**	**0.86 J**	**0.31 J**	0.98 U	0.3 U	**0.021 J**	0.56 U	0.24 U	0.25 UJ	**0.024 J**	270 U	0.24 U	320 U	**7.6 =**	24 U	10 U	6 U	0.34 U	0.26 UJ
71432	Benzene	**0.37 =**	0.057 U	**6 =**	**0.0063 =**	0.063 U	0.06 U	**1.1 =**	**1.5 =**	**0.027 J**	**3.5 =**	**6.9 =**	**0.17 J**	0.0013 UJ	**230 J**	**10 =**		**32 =**	**140 =**	**12 =**	**17 =**	0.073 UJ	**0.058 J**
75150	Carbon disulfide	0.036 U	0.041 U	0.2 U	0.00075 U	0.045 U	0.042 U	0.15 U	0.046 U	**0.0026 J**	0.085 U	0.037 U	0.039 UJ	**0.017 J**	41 U	0.037 U	49 U	0.042 U	3.6 U	1.6 U	0.92 U	0.052 UJ	0.039 UJ
56235	Carbon tetrachloride	0.065 U	0.073 U	0.35 U	0.0014 U	0.08 U	0.076 U	0.27 U	0.083 U	0.0017 UJ	0.15 U	0.066 U	0.07 UJ	0.0016 UJ	74 U	0.066 U	89 U	0.076 U	6.5 U	2.8 U	1.6 U	0.093 UJ	0.07 UJ
108907	Chlorobenzene	**8.3 =**	0.057 U	**0.54 J**	0.0011 U	0.063 U	**0.51 =**	**51 =**	**200 =**	**0.0024 J**	**18 =**	**4.4 =**	0.055 UJ	0.0013 UJ	**89 J**	0.052 U	**180 J**	**2.4 =**	**75 =**	**33 =**	**46 =**	0.073 UJ	**0.23 J**
75003	Chloroethane	0.07 U	0.078 U	0.38 U	0.0015 U	0.086 U	0.081 U	0.29 U	0.089 U	0.0018 UJ	0.16 U	0.071 U	0.075 UJ	0.0017 UJ	79 U	0.07 U	95 U	0.082 U	6.9 U	3 U	1.8 U	0.099 UJ	0.076 UJ
67663	Chloroform	0.038 U	0.043 U	0.21 U	0.00079 U	0.047 U	0.044 U	0.16 U	0.049 U	0.001 UJ	0.09 U	0.039 U	0.041 UJ	0.00095 UJ	43 U	0.038 U	52 U	0.045 U	3.8 U	1.7 U	0.96 U	0.054 UJ	0.041 UJ
156592	cis-1,2-Dichloroethene	0.045 U	0.05 U	0.24 U	0.00093 U	0.055 U	**0.13 J**	0.18 U	0.057 U	0.0012 UJ	0.11 U	0.045 U	0.048 UJ	0.0011 UJ	51 U	0.045 U	61 U	0.052 U	4.4 U	1.9 U	1.1 U	0.063 UJ	0.048 UJ
1006101	cis-1,3-Dichloropropene	0.047 U	0.052 U	0.25 U	0.00097 U	0.057 U	0.054 U	0.19 U	0.059 U	0.0012 UJ	0.11 U	0.047 U	0.05 UJ	0.0012 UJ	53 U	0.047 U	63 U	0.054 U	4.6 U	2 U	1.2 U	0.066 UJ	0.05 UJ
100414	Ethylbenzene	**0.2 J**	0.094 U	**2.1 =**	**0.0052 =**	0.1 U	0.097 U	**0.76 J**	**0.32 =**	0.0022 UJ	0.2 U	0.085 U	0.09 UJ	0.0021 UJ	95 U	0.084 U	110 U	0.098 U	**23 J**	3.6 U	2.1 U	0.12 UJ	0.091 UJ
108383/	m- and p-Xylenes	**0.84 =**	0.038 U	**4.4 =**	0.00072 U	0.042 U	0.04 U	**1.5 J**	**1.4 =**	0.00091 UJ	**0.18 J**	**0.31 J**	**0.14 J**	0.00086 UJ	**54 J**	0.035 U	**120 J**	**0.58 =**	**99 =**	**5.6 J**	**3 J**	**0.15 J**	0.037 UJ
75092	Methylene chloride	0.075 U	0.083 U	**1.9 =**	0.0015 U	**0.15 J**	**0.16 J**	0.31 U	0.095 U	0.002 UJ	0.18 U	0.076 U	0.08 UJ	0.0019 UJ	85 U	0.075 U	100 U	0.087 U	**8.6 J**	3.2 U	1.9 U	0.11 UJ	0.081 UJ
95476	o-Xylene	**1.2 =**	0.031 U	**1.7 =**	0.00058 U	0.034 U	0.032 U	**2.4 =**	**3.4 =**	0.00074 UJ	0.066 U	**0.11 J**	**0.057 J**	0.0007 UJ	**1000 =**	0.028 U	**1400 =**	**0.92 =**	**130 =**	**14 =**	**8.4 =**	**0.054 J**	0.03 UJ
100425	Styrene	0.028 U	0.032 U	0.15 U	0.00059 U	0.035 U	0.033 U	0.12 U	0.036 U	0.00075 UJ	0.067 U	0.029 U	0.03 UJ	0.00071 UJ	32 U	0.029 U	39 U	0.033 U	2.8 U	1.2 U	0.72 U	0.04 UJ	0.031 UJ
127184	Tetrachloroethene	0.042 U	0.047 U	0.23 U	0.00087 U	0.052 U	0.049 U	0.17 U	0.053 U	0.0011 UJ	0.099 U	0.043 U	0.045 UJ	0.001 UJ	48 U	0.042 U	57 U	0.049 U	4.2 U	1.8 U	1.1 U	0.059 UJ	0.045 UJ
108883	Toluene	**0.25 =**	0.052 U	**44 =**	0.00097 U	**0.62 =**	**0.14 J**	**1.3 =**	**44 =**	**0.016 J**	**1.4 =**	**66 =**	**0.26 J**	0.0012 UJ	**12000 =**	0.047 U	**56000 =**	**63 =**	**11000 =**	**360 =**	**310 =**	**4.6 J**	0.05 UJ
156605	trans-1,2-Dichloroethene	0.046 U	0.051 U	0.25 U	0.00096 U	0.057 U	0.054 U	0.19 U	0.059 U	0.0012 UJ	0.11 U	0.047 U	0.049 UJ	0.0012 UJ	52 U	0.046 U	63 U	0.054 U	4.6 U	2 U	1.2 U	0.065 UJ	0.05 UJ
1006102	trans-1,3-Dichloropropene	0.045 U	0.05 U	0.24 U	0.00094 U	0.056 U	0.053 U	0.19 U	0.057 U	0.0012 UJ	0.11 U	0.046 U	0.048 UJ	0.0011 UJ	51 U	0.045 U	61 U	0.053 U	4.5 U	2 U	1.1 U	0.064 UJ	0.049 UJ
79016	Trichloroethene	0.042 U	0.047 U	0.23 U	0.00087 U	0.052 U	0.049 U	0.17 U	0.053 U	0.0011 UJ	0.099 U	0.043 U	0.045 UJ	0.001 UJ	48 U	0.042 U	57 U	0.049 U	4.2 U	1.8 U	1.1 U	0.059 UJ	0.045 UJ
75014	Vinyl chloride	0.075 U	0.083 UJ	0.4 U	0.0015 U	0.092 U	0.087 U	0.31 U	0.095 U	0.002 UJ	0.18 U	0.076 U	0.08 UJ	0.0019 UJ	85 U	0.075 U	100 U	0.087 U	7.4 U	3.2 U	1.9 U	0.11 UJ	0.081 UJ
1330207	Xylenes	**2 =**	0.068 U	**6.1 =**	0.0013 U			**3.9 =**	**4.8 =**	0.0016 UJ	**0.22 J**	**0.42 J**	**0.19 J**	0.0015 UJ	**1100 =**	0.061 U	**1500 =**	**1.5 =**	**230 =**	**20 J**	**11 J**	**0.2 J**	0.065 UJ
SEMIVOLATILE ORGANICS (m																							
90120	1-Methylnaphthalene	0.046 U	0.048 U	**0.58 J**	0.047 U	0.051 U	0.048 U	0.044 U	0.049 U	0.044 U	0.048 U	0.046 U	**0.11 J**	0.048 U	**0.084 J**	0.046 U	**0.82 =**	0.05 U	**1.1 =**	0.047 U	0.05 U	0.049 U	**0.12 J**
95578	2-Chlorophenol	0.054 U	0.055 U	0.31 U	0.055 U	0.059 U	0.056 U	**0.41 =**	**3.4 =**	0.051 U	0.056 U	0.054 U	0.048 U	0.056 U	0.054 U	0.054 U	0.058 U	0.058 U	0.05 U	0.055 U	0.059 U	0.057 U	0.053 U
91576	2-Methylnaphthalene	0.046 U	0.048 U	**0.62 J**	0.047 U	0.051 U	0.048 U	0.044 U	0.049 U	0.044 U	0.048 U	0.046 U	**0.22 J**	0.048 U	**0.13 J**	0.046 U	**1.4 =**	0.05 U	**1.6 =**	0.047 U	0.05 U	**0.12 J**	**0.25 J**
95487	2-Methylphenol (o-cresol)	0.052 U	0.054 U	0.3 U	0.054 U	0.058 U	0.055 U	0.05 U	**0.71 =**	0.05 U	0.055 U	**0.44 =**	0.047 U	0.054 U	**3.2 =**	**0.13 J**	**1.2 =**	**0.77 =**	**2.3 =**	**0.64 =**	**1 =**	0.055 U	0.052 U
6579496	3 & 4 Methylphenol	0.054 U	0.055 U	0.31 U	**0.22 J**	0.059 U	0.056 U	0.051 U	**0.6 =**	0.051 U	**0.16 J**	**0.43 =**	0.048 U	0.056 U	**0.13 J**	**0.42 J**	**0.57 =**	**1 =**	**1.6 =**	**0.66 =**	**0.89 =**	0.057 U	0.053 U
106445	4-Methylphenol (p-cresol)																						
83329	Acenaphthene	0.046 U	0.048 U	0.26 U	0.047 U	**0.16 J**	0.048 U	0.044 U	0.049 U	0.044 U	0.048 U	0.046 U	0.041 U	0.048 U	0.047 U	0.046 U	**0.49 =**	0.05 U	**0.42 =**	0.047 U	0.05 U	0.049 U	0.046 U
208968	Acenaphthylene[2]	0.05 U	0.052 U	0.29 U	0.051 U	**0.38 J**	0.052 U	0.048 U	0.053 U	0.048 U	0.052 U	0.05 U	**0.11 J**	0.052 U	0.051 U	0.05 U	**0.89 =**	0.054 U	0.046 U	0.051 U	0.054 U	0.053 U	0.05 U
120127	Anthracene	0.063 U	0.065 U	0.36 U	0.064 U	**1.3 =**	0.065 U	0.06 U	0.067 U	0.06 U	0.065 U	0.063 U	**0.25 J**	0.065 U	**0.15 J**	0.063 U	**3.2 =**	0.068 U	**0.6 =**	0.064 U	0.068 U	**0.19 J**	**0.3 J**
56553	Benzo(a)anthracene	0.049 U	0.05 U	**1.4 J**	0.05 U	**4.7 =**	0.051 U	0.046 U	0.052 U	0.047 U	0.051 U	0.049 U	**1.8 =**	0.05 U	**0.15 J**	0.049 U	**5.2 =**	0.053 U	**0.76 =**	0.05 U	0.053 U	**1.3 =**	**2 =**
50328	Benzo(a)pyrene	0.046 U	0.048 U	**2.2 J**	0.047 U	**5.1 =**	0.048 U	0.044 U	0.049 U	0.044 U	0.048 U	0.046 U	**2.4 =**	0.048 U	**0.12 J**	0.046 U	**4.7 =**	0.05 U	**0.79 =**	0.047 U	0.05 U	**1.3 =**	**2.2 =**
205992	Benzo(b)fluoranthene	0.065 U	0.067 U	**3.4 =**	0.067 U	**6.6 =**	0.068 U	0.062 U	0.07 U	0.063 U	0.068 U	0.065 U	**3.8 =**	0.068 U	**0.13 J**	0.065 U	**7.5 =**	0.071 U	**1.1 =**	0.067 U	**0.12 J**	**2.8 =**	**3.4 =**
191242	Benzo(g,h,i)perylene[2]	0.05 U	0.052 U	**2.3 J**	0.051 U	**2.8 =**	0.052 U	0.048 U	0.053 U	0.048 U	0.052 U	0.05 U	**3.1 =**	0.052 U	0.051 U	0.05 U	**3.4 =**	0.054 U	**0.34 J**	0.051 U	0.054 U	**1.2 =**	**2.9 =**
207089	Benzo(k)fluoranthene	0.046 U	0.048 U	**1.1 J**	0.047 U	**2.8 =**	0.048 U	0.044 U	0.049 U	0.044 U	0.048 U	0.046 U	**1 =**	0.048 U	**0.1 J**	0.046 U	**2.7 =**	0.05 U	**0.38 J**	0.047 U	0.05 U	**0.78 =**	**0.96 =**
117817	Bis(2-ethylhexyl)phthalate	0.047 U	0.049 U	0.27 U	0.049 U	0.052 U	0.049 U	0.045 U	0.05 U	0.045 U	0.049 U	0.047 U	**0.11 J**	0.049 U	0.048 U	0.047 U	0.051 U	0.051 U	0.044 U	0.048 U	0.052 U	0.05 U	**0.13 J**
86748	Carbazole	0.047 U	0.049 U	0.27 U	0.049 U	**0.34 J**	0.049 U	0.045 U	0.05 U	0.045 U	0.049 U	0.047 U	**0.25 J**	0.049 U	0.048 U	0.047 U	**3.7 =**	0.051 U	**0.34 J**	0.048 U	0.052 U	**0.16 J**	**0.3 J**
218019	Chrysene	0.045 U	0.046 U	**1.8 J**	0.046 U	**4.2 =**	0.047 U	0.043 U	0.048 U	0.043 U	0.047 U	0.045 U	**2.6 =**	0.046 U	**0.23 J**	0.045 U	**4.5 =**	0.049 U	**0.77 =**	0.046 U	0.049 U	**2 =**	**2.3 =**
53703	Dibenzo(a,h)anthracene	0.045 U	0.046 U	**0.61 J**	0.046 U	**0.97 =**	0.047 U	0.043 U	0.048 U	0.043 U	0.047 U	0.045 U	**0.85 =**	0.046 U	0.045 U	0.045 U	**1 =**	0.049 U	**0.12 J**	0.046 U	0.049 U	**0.54 =**	**0.88 =**
132649	Dibenzofuran	0.064 U	0.066 U	0.37 U	0.066 U	**0.19 J**	0.067 U	0.061 U	0.068 U	0.061 U	0.067 U	0.064 U	0.058 U	0.066 U	0.065 U	0.064 U	**1.6 =**	0.07 U	**0.71 =**	0.065 U	0.07 U	0.068 U	**0.11 J**
84662	Diethylphthalate	**0.11 J**	0.052 U	0.29 U	0.051 U	0.055 U	0.052 U	0.048 U	0.053 U	0.048 U	**0.09 J**	**0.083 J**	0.045 U	0.052 U	0.051 U	0.05 U	0.054 U	0.054 U	**0.072 J**	**0.077 J**	**0.13 J**	0.053 U	0.05 U
206440	Fluoranthene	0.06 U	0.062 U	**1.2 J**	0.062 U	**9.6 =**	0.063 U	0.057 U	0.064 U	0.058 U	0.063 U	0.06 U	**2.1 =**	0.062 U	**0.6 =**	0.06 U	**12 =**	0.065 U	**2 =**	0.062 U	**0.14 J**	**1.9 =**	**2.1 =**
86737	Fluorene	0.061 U	0.063 U	0.35 U	0.063 U	**0.72 =**	0.064 U	0.058 U	0.065 U	0.059 U	0.064 U	0.062 U	**0.17 J**	0.064 U	0.062 U	0.061 U	**3.3 =**	0.067 U	**0.86 =**	0.063 U	0.067 U	0.065 U	**0.24 J**
193395	Indeno(1,2,3-cd)pyrene	0.046 U	0.048 U	**1.8 J**	0.047 U	**2.3 =**	0.048 U	0.044 U	0.049 U	0.044 U	0.048 U	0.046 U	**2.7 =**	0.048 U	0.047 U	0.046 U	**2.5 =**	0.05 U	**0.23 J**	0.047 U	0.05 U	**1.2 =**	**2.4 =**
91203	Naphthalene	0.046 U	**0.12 J**	**8.3 =**	**0.071 J**	**0.37 J**	0.048 U	**0.15 J**	**1.5 =**	0.044 U	0.048 U	0.046 U	**1.2 =**	0.048 U	**2.1 =**	0.046 U	**12 =**	**0.57 =**	**2.8 =**	0.047 U	**0.15 J**	**0.22 J**	**1.3 =**
85018	Phenanthrene[2]	0.058 U	0.059 U	**0.73 J**	0.059 U	**5.1 =**	0.06 U	0.055 U	0.061 U	0.055 U	0.06 U	0.058 U	**1 =**	0.06 U	**0.75 =**	0.058 U	**11 =**	0.063 U	**3.2 =**	0.059 U	**0.2 J**	**1.1 =**	**1.3 =**
108952	Phenol	0.046 U	0.048 U	**3.4 =**	**0.12 J**	0.051 U	**0.19 J**	**0.093 J**	**0.71 =**	**0.16 J**	0.048 U	**0.58 =**	**0.75 =**	0.048 U	**0.75 =**	**51 =**	0.05 U	**19 =**	**14 =**	**59 =**	**64 =**	0.049 U	**0.86 =**
129000	Pyrene	0.059 U	0.061 U	**1.2 J**	0.06 U	**7.9 =**	0.061 U	0.056 U	0.063 U	0.056 U	0.061 U	0.059 U	**2.1 =**	0.061 U	**0.5 =**	0.059 U	**10 =**	0.064 U	**1.6 =**	0.06 U	**0.14 J**	**1.7 =**	**2.4 =**

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0010 (9-11 ft) 15-Jan-08	CM-SB0011 (10-12 ft) 16-Jan-08	CM-SB0011 (2-4 ft) 16-Jan-08	CM-SB0011 (6-8 ft) 16-Jan-08	CM-SB0012 (2-4 ft) 18-Jan-08	CM-SB0012 (8-10 ft) 18-Jan-08	CM-SB0013 (2-4 ft) 16-Jan-08	CM-SB0013 (6-8 ft) 16-Jan-08	CM-SB0015 (2-4 ft) 15-Jan-08	CM-SB0015 (6-8 ft) 15-Jan-08	CM-SB0015 (9-11 ft) 15-Jan-08	CM-SB0016 (2-4 f) 18-Jan-08	CM-SB0016 (4-6 ft) 18-Jan-08	CM-SB0017 (2-4) 16-Jan-08	CM-SB0017 (8-10 ft) 16-Jan-08	CM-SB0018 (2-4) 16-Jan-08	CM-SB0018 (7-9 ft) 16-Jan-08	CM-SB0019 (2-4 ft) 15-Jan-08	CM-SB0019 (6-8 ft) 15-Jan-08	CM-SB0019 (9-11 ft) 15-Jan-08	CM-SB0020 (2-4 ft) 18-Jan-08	CM-SB0020 (4-6 ft) 18-Jan-08
INORGANICS (mg/kg)																							
7440360	Antimony, Total																						
7440382	Arsenic, Total																						
7440393	Barium, Total																						
7440417	Beryllium, Total																						
7440439	Cadmium, Total																						
7440473	Chromium, Total																						
7440508	Copper, Total																						
7439921	Lead, Total																						
7440020	Nickel, Total																						
7782492	Selenium, Total																						
7440280	Thallium, Total																						
7440666	Zinc, Total																						
57125	Cyanide, Total																						

de for nondetected result
e for estimated result
cates a detected chemical concentration.
vember 2015. Regional Screening Levels (RSLs).
d RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate concentration.
ained as a COPC because the maximum concentration exceeds the RSL
cluded as a COPC because the maximum concentration does not exceed the RSL
nservatively retained as a COPC because there is no published RSL
ained as a COPC because it is included in the group of potentially carcinogenic PAHs,
ne in that group has exceeded its screening level.
EPA, November 2015, RSL table.

COPC = chemical of potential concern
SSL = groundwater protection soil screening level (Arcadis & CH2MHill, 2009)

U = qualifier cod
J = qualifier code
BOLD font indic
1 = USEPA, Nov
2 = No publishec
3 = chemical reta
4 = chemical exc
5 = chemical con
6 = chemical reta
and at least or
7 = Source: USE

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0021 (12-14 ft) 18-Jan-08		CM-SB0021 (2-4 ft) 18-Jan-08		CM-SB0021 (6-8 ft) 18-Jan-08		CM-SB0022 (2-4 ft) 15-Jan-08		CM-SB0022 (5-7 ft) 15-Jan-08		CM-SB0023 (2-4 ft) 15-Jan-08		CM-SB0024 (12-14 ft) 18-Jan-08		CM-SB0024 (2-4 ft) 18-Jan-08		CM-SB0024 (6-8 fr) 18-Jan-08		CM-SB0025 (17-19 ft) 17-Jan-08		CM-SB0025 (2-4 ft) 17-Jan-08		CM-SB0025 (9-11 ft) 17-Jan-08		CM-SB0026 (2-4 ft) 16-Jan-08		CM-SB0026 (7-9 ft) 16-Jan-08		CM-SB0027 (16-18 ft) 14-Jan-08		CM-SB0027 (2-4 ft) 14-Jan-08		CM-SB0027 (8-10 ft) 14-Jan-08		CM-SB0028 (10-12 ft) 14-Jan-08		CM-SB0028 (7-9 ft) 14-Jan-08		CM-SB0029 (2-4 ft) 17-Jan-08		CM-SB0029 (7-9 ft) 17-Jan-08		CM-SB0030 (2-4 ft) 18-Jan-08	
VOLATILE ORGANICS (mg/kg)																																													
79005	1,1,2-Trichloroethane	0.58	U	0.062	UJ	0.05	UJ	0.97	U	0.4	U	0.056	U	0.056	U	13	UJ	0.23	U	0.56	U	12	U	0.053	U	0.061	U	0.063	U	0.064	U	2.7	U	5	U	0.0011	U	0.066	U	1.3	U	0.082	U	0.25	UJ
120821	1,2,4-Trichlorobenzene	0.054	U	0.051	U	0.049	U	0.05	U	0.056	U	0.021	U	0.054	U	0.052	UJ	0.05	U	0.052	UJ	0.25	UJ	0.05	UJ	0.1	U	0.058	U	0.057	U	0.043	U	0.049	U	0.051	U	0.053	U	0.26	U	0.058	U	0.051	U
107062	1,2-Dichloroethane	0.97	U	0.1	UJ	0.084	UJ	1.6	U	0.66	U	0.093	U	0.094	U	22	UJ	0.39	U	0.94	U	20	U	0.088	U	0.1	U	0.11	U	0.11	U	4.5	U	8.4	U	0.0019	U	0.11	U	2.1	U	0.14	U	**1.1**	**J**
78875	1,2-Dichloropropane	0.58	U	0.062	UJ	0.05	UJ	0.97	U	0.4	U	0.056	U	0.056	U	13	UJ	0.23	U	0.56	U	12	U	0.053	U	0.061	U	0.063	U	0.064	U	2.7	U	5	U	0.0011	U	0.066	U	1.3	U	0.082	U	0.25	UJ
106467	1,4-Dichlorobenzene	0.045	U	0.043	U	0.041	U	0.042	U	0.046	U	0.018	U	0.045	U	0.043	UJ	0.042	U	0.044	UJ	0.21	UJ	0.042	UJ	0.087	U	0.049	U	0.048	U	0.036	U	0.041	U	0.042	U	0.044	U	0.22	U	0.048	U	0.042	U
78933	2-Butanone (MEK)	5.3	U	0.57	UJ	0.46	U	8.9	U	3.7	U	0.51	U	0.52	U	120	UJ	**2.6**	**J**	**6.3**	**J**	110	U	0.49	U	0.56	U	0.58	U	0.58	U	25	U	46	U	0.01	U	0.6	U	11	U	0.75	U	2.3	UJ
67641	Acetone	2.5	U	**0.72**	**J**	0.21	UJ	4.1	U	1.7	U	0.24	U	**0.26**	**J**	**55**	**J**	**1.7**	**J**	**3.6**	**J**	52	U	0.23	U	0.26	U	0.27	U	0.27	UJ	11	U	21	UJ	0.0047	U	0.28	UJ	5.3	U	**0.7**	**J**	1.1	UJ
71432	Benzene	**5.2**	=	**17**	**J**	0.046	UJ	**2.7**	**J**	**62**	=	**0.5**	=	**46**	=	**1400**	**J**	**29**	=	**73**	=	**200**	=	**9.7**	=	**0.4**	=	**7.4**	=	**46**	=	**160**	=	**95**	**J**	**0.014**	=	**0.72**	**J**	**130**	=	**3.3**	=	**0.44**	**J**
75150	Carbon disulfide	0.38	U	0.04	UJ	0.033	UJ	0.63	U	0.26	U	0.036	U	0.037	U	8.4	UJ	0.15	U	0.37	U	7.9	U	0.034	U	**0.066**	**J**	0.041	U	0.041	U	1.7	U	3.3	U	**0.00074**	**J**	0.043	U	0.81	U	0.053	U	0.16	UJ
56235	Carbon tetrachloride	0.68	U	0.072	UJ	0.059	UJ	1.1	U	0.46	U	0.065	U	0.066	U	15	UJ	0.27	U	0.66	U	14	U	0.062	U	0.071	U	0.074	U	0.074	U	3.1	UJ	5.9	U	0.0013	UJ	0.077	U	1.5	U	0.096	U	0.3	UJ
108907	Chlorobenzene	**0.65**	**J**	**9.2**	**J**	**0.83**	**J**	0.89	U	**3.2**	=	**0.9**	=	**12**	=	**28**	**J**	**4.5**	=	**1.2**	**J**	**59**	=	**1.1**	=	0.056	U	**3.4**	=	**1.9**	**J**	**66**	**J**	**36**	**J**	**0.053**	**J**	**0.087**	**J**	1.1	U	0.075	U	**39**	**J**
75003	Chloroethane	0.73	U	0.077	UJ	0.063	UJ	1.2	U	0.5	U	0.07	U	0.07	U	16	UJ	0.29	U	0.7	U	15	U	0.066	U	0.076	U	0.079	U	0.08	U	3.3	U	6.3	U	0.0014	U	0.082	U	1.6	U	0.1	U	0.32	UJ
67663	Chloroform	0.4	U	0.042	UJ	0.034	UJ	0.67	U	0.27	U	0.038	U	0.039	U	8.8	UJ	0.16	U	0.38	U	8.3	U	0.036	U	0.041	U	0.043	U	0.043	UJ	1.8	UJ	3.4	UJ	0.00076	UJ	0.045	UJ	0.86	U	0.056	U	0.17	UJ
156592	cis-1,2-Dichloroethene	0.46	U	0.05	UJ	0.04	UJ	0.78	U	0.32	U	0.045	U	**0.083**	**J**	10	UJ	0.19	U	0.45	U	9.8	U	0.042	U	0.049	U	0.051	U	0.051	U	2.1	U	4	U	0.00089	U	0.053	U	1	U	0.066	U	0.2	UJ
1006101	cis-1,3-Dichloropropene	0.48	U	0.052	UJ	0.042	UJ	0.81	U	0.33	U	0.046	U	0.047	U	11	UJ	0.2	U	0.47	U	10	U	0.044	U	0.051	U	0.053	U	0.053	U	2.2	U	4.2	U	0.00093	U	0.055	U	1	U	0.068	UJ	0.21	UJ
100414	Ethylbenzene	0.87	U	**0.86**	**J**	0.076	UJ	1.5	U	0.6	U	0.083	U	0.085	U	19	UJ	0.35	U	0.84	U	18	U	0.08	U	0.091	U	0.095	U	0.095	U	**29**	=	**15**	**J**	0.0017	U	0.099	U	**4.8**	**J**	0.12	U	0.38	UJ
108383/	m- and p-Xylenes	0.36	U	**8.6**	**J**	0.031	UJ	0.6	U	0.25	U	0.034	U	0.035	U	8	UJ	**0.96**	**J**	0.35	U	**11**	**J**	**0.077**	**J**	**0.11**	**J**	0.039	U	**0.048**	**J**	**230**	=	**60**	=	0.00069	U	**0.048**	**J**	**13**	=	0.051	UJ	**0.28**	**J**
75092	Methylene chloride	0.77	U	**0.11**	**J**	0.067	UJ	1.3	U	0.53	U	0.074	U	**0.14**	**J**	17	UJ	0.31	U	**6.6**	=	**130**	=	**0.71**	=	0.081	U	0.084	U	**0.66**	=	**5.7**	**J**	**43**	=	0.0015	U	0.088	U	**12**	=	**0.18**	**J**	0.34	UJ
95476	o-Xylene	**4.9**	=	**27**	**J**	**0.027**	**J**	0.49	U	**1.4**	**J**	0.028	U	**0.11**	**J**	**37**	**J**	**19**	=	0.28	U	**100**	=	**0.029**	**J**	**0.036**	**J**	**0.17**	**J**	**0.052**	**J**	**220**	=	**200**	=	0.00056	U	0.033	U	0.63	U	0.041	U	**0.41**	**J**
100425	Styrene	0.3	U	**0.9**	**J**	0.026	U	0.49	U	0.2	U	0.028	U	0.029	U	6.6	UJ	0.12	U	0.29	U	6.2	U	0.027	U	0.031	U	0.032	U	0.032	UJ	1.4	UJ	2.6	UJ	0.00057	UJ	0.033	UJ	0.64	U	0.042	U	0.13	UJ
127184	Tetrachloroethene	0.44	U	0.046	UJ	0.038	UJ	0.73	U	0.3	U	0.042	U	0.042	U	9.7	UJ	0.18	U	0.42	U	9.2	U	0.04	U	0.046	U	0.047	U	0.048	UJ	2	UJ	3.8	UJ	0.00084	UJ	0.049	UJ	0.94	U	0.061	U	0.19	UJ
108883	Toluene	**97**	=	**68**	**J**	**0.067**	**J**	**2.5**	**J**	**25**	=	**0.79**	=	**0.84**	=	**1300**	**J**	**970**	=	**1.3**	**J**	**1200**	=	**0.25**	=	**0.69**	=	**13**	=	**0.42**	=	**600**	=	**740**	=	0.00093	U	0.055	U	**1.9**	**J**	0.068	U	**45**	**J**
156605	trans-1,2-Dichloroethene	0.48	U	0.051	UJ	0.042	UJ	0.8	U	0.33	U	0.046	U	0.047	U	11	UJ	0.19	U	0.46	U	10	U	0.044	U	0.05	U	0.052	U	0.052	U	2.2	U	4.2	U	0.00092	U	0.054	U	1	U	0.068	U	0.21	UJ
1006102	trans-1,3-Dichloropropene	0.47	U	0.05	UJ	0.041	U	0.79	U	0.32	U	0.045	U	0.046	U	10	UJ	0.19	U	0.45	U	9.9	U	0.043	U	0.049	U	0.051	U	0.051	U	2.2	U	4.1	U	0.0009	U	0.053	U	1	U	0.066	UJ	0.2	UJ
79016	Trichloroethene	0.44	U	0.046	UJ	0.038	UJ	0.73	U	0.3	U	0.042	U	0.042	U	9.7	UJ	**0.3**	**J**	0.42	UJ	9.2	UJ	0.04	UJ	0.046	U	0.047	U	0.048	UJ	2	UJ	3.8	UJ	0.00084	UJ	0.049	UJ	0.94	UJ	0.061	UJ	0.19	UJ
75014	Vinyl chloride	0.77	U	0.083	UJ	0.067	UJ	1.3	U	0.53	U	0.074	U	0.075	U	17	UJ	0.31	U	0.75	U	16	U	0.071	U	0.081	U	0.084	U	0.085	U	3.6	U	6.7	U	0.0015	U	0.088	U	1.7	U	0.11	U	0.34	UJ
1330207	Xylenes	**5.2**	**J**	**72**	**J**	0.055	UJ	1.1	U	**1.4**	**J**	0.06	U	**0.14**	**J**	**42**	**J**	**20**	**J**	0.61	U	**110**	=	**0.11**	**J**	**0.15**	**J**	**0.19**	**J**	**0.1**	**J**	**450**	=	**260**	=	0.0012	U	0.071	U	**14**	=	0.089	U	**0.69**	**J**
SEMIVOLATILE ORGANICS (m																																												
90120	1-Methylnaphthalene	0.046	U	**0.1**	**J**	0.042	U	**0.051**	**J**	0.048	U	**0.55**	=	**0.046**	**U**	**0.4**	**J**	0.043	U	0.045	UJ	0.22	UJ	0.043	UJ	**0.51**	**J**	0.05	U	0.049	U	**0.097**	**J**	**0.13**	**J**	0.043	U	0.046	U	**1.5**	**J**	0.049	U	**1.5**	=
95578	2-Chlorophenol	0.054	U	0.051	U	0.049	U	0.05	U	0.056	U	0.021	U	0.054	U	0.052	U	0.05	U	0.052	U	0.25	U	0.05	U	0.1	U	0.058	U	0.057	U	0.043	U	0.049	U	0.051	U	0.053	U	0.26	U	0.058	U	0.051	U
91576	2-Methylnaphthalene	0.046	U	**0.14**	**J**	0.042	U	**0.089**	**J**	0.048	U	**0.66**	=	0.046	U	**0.75**	**J**	0.043	U	0.045	UJ	**0.67**	**J**	0.043	UJ	**0.5**	**J**	0.05	U	0.049	U	**0.16**	**J**	**0.23**	**J**	0.043	U	0.046	U	**2**	**J**	0.049	U	**1.3**	=
95487	2-Methylphenol (o-cresol)	**0.79**	=	**0.24**	**J**	0.048	U	0.049	U	0.054	U	0.021	U	0.053	U	**0.37**	**J**	**0.17**	**J**	0.051	U	**1.6**	**J**	0.049	U	0.1	U	0.057	U	0.056	U	0.042	U	**0.82**	=	0.049	U	0.052	U	0.25	U	0.056	U	**0.33**	**J**
6579496	3 & 4 Methylphenol	**1.2**	=	**0.23**	**J**	0.049	U	0.05	U	**0.23**	**J**	**0.049**	**J**	0.054	U	**0.59**	=	**1.1**	=	0.052	U	**0.98**	**J**	**0.17**	**J**	0.1	U	0.058	U	0.057	U	0.043	U	**0.74**	=	0.051	U	0.053	U	0.26	U	0.058	U	0.051	U
106445	4-Methylphenol (p-cresol)																																												
83329	Acenaphthene	0.046	U	**0.19**	**J**	0.042	U	0.043	U	0.048	U	**0.17**	=	0.046	U	**0.88**	**J**	0.043	U	0.045	UJ	0.22	UJ	0.043	UJ	**0.4**	**J**	0.05	U	0.049	U	**0.057**	**J**	**0.11**	**J**	0.043	U	0.046	U	**3.9**	=	0.049	U	**0.2**	**J**
208968	Acenaphthylene[2]	0.05	U	**0.092**	**J**	0.045	U	0.047	U	0.052	U	**0.21**	=	0.05	U	**3.3**	**J**	0.047	U	0.048	UJ	0.23	UJ	0.046	UJ	**1.7**	=	0.054	U	0.053	U	0.04	U	**0.058**	**J**	0.047	U	0.049	U	**2.7**	=	0.054	U	**0.3**	**J**
120127	Anthracene	0.063	U	**0.32**	**J**	0.057	U	**0.089**	**J**	0.065	U	**0.28**	=	0.063	U	**21**	**J**	0.059	U	0.061	UJ	**0.62**	**J**	0.058	UJ	**4.3**	=	0.068	U	0.067	U	**0.14**	**J**	**0.47**	=	0.059	U	0.062	U	**20**	=	0.067	U	**0.43**	=
56553	Benzo(a)anthracene	0.049	U	**0.71**	=	0.044	U	**0.49**	=	0.05	U	**0.55**	=	0.049	U	**30**	**J**	0.046	U	0.047	UJ	**2.4**	**J**	0.045	UJ	**11**	=	0.053	U	0.052	U	**0.27**	**J**	**0.76**	=	0.046	U	**0.16**	**J**	**39**	=	0.052	U	**1.6**	=
50328	Benzo(a)pyrene	0.046	U	**0.82**	=	0.042	U	**0.47**	=	0.048	U	**0.74**	=	0.046	U	**20**	**J**	0.043	U	0.045	UJ	0.22	UJ	0.043	UJ	**15**	=	0.05	U	0.049	U	**0.22**	**J**	**0.68**	=	0.043	U	**0.26**	**J**	**29**	=	0.049	U	**2.1**	=
205992	Benzo(b)fluoranthene	0.066	U	**1.5**	=	0.059	U	**0.88**	=	0.068	U	**1.2**	=	0.066	U	**30**	**J**	0.061	U	0.063	UJ	0.31	UJ	0.061	UJ	**19**	=	0.071	U	0.07	U	**0.31**	**J**	**0.96**	=	0.061	U	**0.4**	**J**	**43**	=	0.07	U	**4.3**	=
191242	Benzo(g,h,i)perylene[2]	0.05	U	**0.66**	=	0.045	U	**0.35**	**J**	0.052	U	**0.56**	=	0.05	U	**14**	**J**	0.047	U	0.048	UJ	**1.7**	**J**	0.046	UJ	**9.7**	=	0.054	U	0.053	U	**0.13**	**J**	**0.34**	**J**	0.047	U	**0.17**	**J**	**14**	=	0.054	U	**1.3**	=
207089	Benzo(k)fluoranthene	0.046	U	**0.65**	=	0.042	U	**0.35**	**J**	0.048	U	**0.29**	=	0.046	U	**12**	**J**	0.043	U	0.045	UJ	0.22	UJ	0.043	UJ	**6.5**	=	0.05	U	0.049	U	**0.11**	**J**	**0.34**	**J**	0.043	U	**0.1**	**J**	**16**	=	0.049	U	**1.6**	=
117817	Bis(2-ethylhexyl)phthalate	0.048	U	0.045	U	0.043	U	0.044	U	0.049	U	0.019	U	0.048	U	0.046	UJ	0.044	U	0.046	UJ	0.22	UJ	0.044	UJ	0.092	U	0.051	U	0.051	U	0.038	U	0.044	U	0.045	U	0.047	U	0.23	U	0.051	U	**0.13**	**J**
86748	Carbazole	0.048	U	**0.2**	**J**	0.043	U	0.044	U	0.049	U	**0.35**	=	0.048	U	**1.6**	**J**	**0.12**	**J**	0.046	UJ	0.22	UJ	0.044	UJ	**1.8**	=	0.051	U	0.051	U	0.038	U	**0.21**	**J**	0.045	U	**0.057**	**J**	**5.5**	=	0.051	U	**0.15**	**J**
218019	Chrysene	0.045	U	**0.73**	=	0.041	U	**0.67**	=	0.046	U	**0.57**	=	0.045	U	**29**	**J**	0.042	U	0.044	UJ	**2.2**	**J**	0.042	UJ	**11**	=	0.049	U	0.048	U	**0.25**	**J**	**0.7**	=	0.042	U	**0.18**	**J**	**31**	=	0.048	U	**2.3**	=
53703	Dibenzo(a,h)anthracene	0.045	U	**0.17**	**J**	0.041	U	**0.14**	**J**	0.046	U	**0.2**	=	0.045	U	**4.7**	=	0.042	U	0.044	UJ	0.21	UJ	0.042	UJ	**3**	=	0.049	U	0.048	U	0.036	U	**0.064**	**J**	0.042	U	**0.058**	**J**	0.22	U	0.048	U	**0.53**	=
132649	Dibenzofuran	0.065	U	**0.32**	**J**	0.058	U	0.06	U	0.066	U	**0.34**	=	0.065	U	**3.6**	**J**	0.06	U	0.062	UJ	0.3	UJ	0.06	UJ	**0.9**	=	0.07	U	0.068	U	**0.094**	**J**	**0.3**	**J**	0.06	U	0.063	U	**4.2**	=	0.069	U	**0.58**	=
84662	Diethylphthalate	0.05	U	0.047	U	0.045	U	0.047	U	**0.099**	**J**	0.02	U	0.05	U	0.048	UJ	0.047	U	0.048	UJ	0.23	UJ	0.046	UJ	0.097	U	0.054	U	0.053	U	0.04	U	**0.28**	**J**	0.047	U	0.049	U	0.24	U	0.054	U	0.047	U
206440	Fluoranthene	0.061	U	**1.7**	=	0.055	U	**0.77**	=	0.062	U	**1.1**	=	0.061	U	**70**	=	**0.19**	**J**	0.058	UJ	**4.1**	**J**	0.056	UJ	**23**	=	0.065	U	0.064	U	**0.55**	=	**2**	=	0.057	U	**0.33**	**J**	**50**	=	0.065	U	**2**	=
86737	Fluorene	0.062	U	**0.45**	=	0.056	U	0.058	U	0.064	U	**0.66**	=	0.062	U	**12**	**J**	0.058	U	0.06	UJ	**0.91**	**J**	0.057	UJ	**2.5**	=	0.067	U	0.066	U	**0.19**	**J**	**0.64**	=	0.058	U	**0.11**	**J**	**13**	=	0.066	U	**0.19**	**J**
193395	Indeno(1,2,3-cd)pyrene	0.046	U	**0.36**	**J**	0.042	U	**0.24**	**J**	0.048	U	**0.32**	=	0.046	U	**14**	**J**	0.043	U	0.045	UJ	**1.3**	**J**	0.043	UJ	**8.5**	=	0.05	U	0.049	U	**0.081**	**J**	**0.29**	**J**	0.043	U	**0.13**	**J**	**10**	**J**	0.049	UJ	**0.92**	=
91203	Naphthalene	0.046	U	**0.6**	=	0.042	U	**0.15**	**J**	0.048	U	**0.87**	=	0.046	U	**0.74**	**J**	**0.11**	**J**	**0.19**	**J**	**10**	**J**	0.043	UJ	**2.3**	=	**0.063**	**J**	0.049	U	**0.39**	=	**0.83**	=	0.043	U	0.046	U	**6**	=	0.049	U	**1.3**	=
85018	Phenanthrene[2]	0.058	U	**1.7**	=	0.052	U	**0.34**	**J**	0.06	U	**0.54**	=	0.058	U	**58**	=	**0.32**	**J**	0.056	UJ	**3.4**	**J**	0.054	UJ	**13**	=	0.063	U	0.062	U	**0.77**	=	**2.4**	=	0.054	U	**0.28**	**J**	**53**	=	0.062	U	**1.9**	=
108952	Phenol	**2**	=	**0.28**	**J**	0.042	U	**1.5**	=	**1.2**	=	**0.18**	=	0.046	U	**1.5**	=	0.043	U	**0.33**	**J**	**0.9**	**J**	**0.23**	**J**	**4.3**	=	0.05	U	**0.41**	**J**	0.037	U	**0.36**	**J**	0.043	U	0.046	U	**0.82**	**J**	**0.61**	=	**1**	=
129000	Pyrene	0.059	U	**1.5**	=	0.054	U	**0.77**	=	0.061	U	**1**	=	0.059	U	**53**	=	**0.15**	**J**	0.057	UJ	**4.1**	**J**	0.055	UJ	**19**	=	0.064	U	0.063	U	**0.57**	=	**1.5**	=	0.055	U	**0.27**	**J**	**58**	**J**	0.063	UJ	**2**	=

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0021 (12-14 ft) 18-Jan-08	CM-SB0021 (2-4 ft) 18-Jan-08	CM-SB0021 (6-8 ft) 18-Jan-08	CM-SB0022 (2-4 ft) 15-Jan-08	CM-SB0022 (5-7 ft) 15-Jan-08	CM-SB0023 (2-4 ft) 15-Jan-08	CM-SB0024 (12-14 ft) 18-Jan-08	CM-SB0024 (2-4 ft) 18-Jan-08	CM-SB0024 (6-8 fr) 18-Jan-08	CM-SB0025 (17-19 ft) 17-Jan-08	CM-SB0025 (2-4 ft) 17-Jan-08	CM-SB0025 (9-11 ft) 17-Jan-08	CM-SB0026 (2-4 ft) 16-Jan-08	CM-SB0026 (7-9 ft) 16-Jan-08	CM-SB0027 (16-18 ft) 14-Jan-08	CM-SB0027 (2-4 ft) 14-Jan-08	CM-SB0027 (8-10 ft) 14-Jan-08	CM-SB0028 (10-12 ft) 14-Jan-08	CM-SB0028 (7-9 ft) 14-Jan-08	CM-SB0029 (2-4 ft) 17-Jan-08	CM-SB0029 (7-9 ft) 17-Jan-08	CM-SB0030 (2-4 ft) 18-Jan-08
INORGANICS (mg/kg)																							
7440360	Antimony, Total																						
7440382	Arsenic, Total																						
7440393	Barium, Total																						
7440417	Beryllium, Total																						
7440439	Cadmium, Total																						
7440473	Chromium, Total																						
7440508	Copper, Total																						
7439921	Lead, Total																						
7440020	Nickel, Total																						
7782492	Selenium, Total																						
7440280	Thallium, Total																						
7440666	Zinc, Total																						
57125	Cyanide, Total																						

e for nondetected result
: for estimated result
:ates a detected chemical concentration.
'ember 2015. Regional Screening Levels (RSLs).
l RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate concentration.
ined as a COPC because the maximum concentration exceeds the RSL
luded as a COPC because the maximum concentration does not exceed the RSL
servatively retained as a COPC because there is no published RSL
ined as a COPC because it is included in the group of potentially carcinogenic PAHs,
ıe in that group has exceeded its screening level.
PA, November 2015, RSL table.

COPC = chemical of potential concern
SSL = groundwater protection soil screening level (Arcadis & CH2MHill, 2009)

U = qualifier code for nondetected
J = qualifier code for estimated res
BOLD font indicates a detected ch
1 = USEPA, November 2015. Re
2 = No published RSL exists for th
3 = chemical retained as a COPC b
4 = chemical excluded as a COPC
5 = chemical conservatively retain
6 = chemical retained as a COPC b
and at least one in that group ha
7 = Source: USEPA, November 20

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0030 (5-7 ft) 18-Jan-08		CM-SB0030 (7-9 ft) 18-Jan-08		CM-SB0031 (17-19 ft) 18-Jan-08		CM-SB0031 (2-4 ft) 18-Jan-08		CM-SB0031 (6-8 ft) 18-Jan-08		CM-SB0032 (2-4 ft) 14-Jan-08		CM-SB0032 (7-9) 14-Jan-08		CM-SB0033 (12-14 ft) 14-Jan-08		CM-SB0033 (8-10 ft) 14-Jan-08		CM-SB0033 (2-4 ft) 14-Jan-08		CM-SB0034 (14-16 ft) 18-Jan-08		CM-SB0034 (2-4 ft) 18-Jan-08		CM-SB0034 (6-8 ft) 18-Jan-08		CM-SB0035 (14-16 ft) 14-Jan-08		CM-SB0035 (2-4 ft) 14-Jan-08		CM-SB0035 (6-8 ft) 14-Jan-08		CM-SB0036 (2-4 ft) 18-Jan-08		CM-SB0036 (6-8 ft) 18-Jan-08		CM-SB0036 (9-11 ft) 18-Jan-08	
VOLATILE ORGANICS (mg/kg)																																							
79005	1,1,2-Trichloroethane	28	UJ	0.063	U	0.0011	UJ	0.11	U	0.001	UJ	4.2	U	0.07	U	0.058	U	0.0013	U	4.6	U	0.001	UJ	0.33	U	0.053	UJ	0.071	U	1.9	U	0.069	U	0.0015	UJ	0.0013	UJ	0.0013	UJ
120821	1,2,4-Trichlorobenzene	0.051	U	0.056	U	0.051	U	0.055	U	0.02	U	0.054	U	0.057	U	0.052	U	0.052	U	0.054	U	0.019	U	0.055	U	0.05	U	0.059	U	0.54	U	0.057	U	0.049	U	0.023	UJ	0.057	U
107062	1,2-Dichloroethane	47	UJ	0.11	U	0.0019	UJ	0.19	U	0.0017	UJ	7	U	0.12	U	0.097	U	0.0022	U	7.6	U	0.0017	UJ	0.55	U	0.088	UJ	0.12	U	3.2	U	0.12	U	0.0026	UJ	0.0022	UJ	0.0021	UJ
78875	1,2-Dichloropropane	28	UJ	0.063	U	0.0011	UJ	0.11	U	0.001	UJ	4.2	U	0.07	U	0.058	U	0.0013	U	4.6	U	0.001	UJ	0.33	U	0.053	UJ	0.071	U	1.9	U	0.069	U	0.0015	UJ	0.0013	UJ	0.0013	UJ
106467	1,4-Dichlorobenzene	0.042	U	0.046	U	0.042	U	0.046	U	0.017	U	0.045	U	0.048	U	0.043	U	0.043	U	0.045	U	**0.026**	**J**	0.046	U	0.042	U	0.049	U	0.45	U	0.048	U	0.041	U	0.019	UJ	0.048	U
78933	2-Butanone (MEK)	260	UJ	0.58	U	0.01	UJ	**1.2**	**J**	0.0093	UJ	38	U	0.64	U	0.53	U	0.012	U	42	U	0.0093	UJ	3	U	0.48	UJ	0.65	U	17	U	0.63	U	0.014	UJ	0.012	UJ	0.012	UJ
67641	Acetone	120	UJ	**7.7**	=	**0.022**	**J**	**3.9**	**J**	**0.021**	**J**	18	U	0.3	UJ	0.25	UJ	**0.014**	**J**	19	U	**0.033**	**J**	**3.1**	**J**	0.22	UJ	0.3	U	8.1	U	0.29	UJ	**0.022**	**J**	**0.007**	**J**	**0.024**	**J**
71432	Benzene	**250**	**J**	**15**	=	0.001	UJ	**1.8**	=	**0.0073**	**J**	**55**	=	**1.1**	**J**	**3.5**	**J**	**0.0056**	=	**760**	=	0.00093	UJ	**7.4**	**J**	0.048	UJ	**3.1**	=	**84**	=	0.063	UJ	**120**	**J**	**0.1**	**J**	**0.0097**	**J**
75150	Carbon disulfide	18	UJ	0.041	U	0.00073	UJ	**0.16**	**J**	**0.00089**	**J**	2.7	U	0.046	U	0.038	U	0.00085	U	3	U	0.00066	UJ	0.22	U	0.034	UJ	0.046	U	1.2	U	0.045	U	0.001	UJ	0.00085	UJ	0.00083	UJ
56235	Carbon tetrachloride	33	UJ	0.074	U	0.0013	UJ	0.13	U	0.0012	UJ	4.9	UJ	0.082	U	0.068	U	0.0015	U	5.4	U	0.0012	UJ	0.39	U	0.062	UJ	0.083	UJ	2.2	U	0.081	U	0.0018	UJ	0.0015	UJ	0.0015	UJ
108907	Chlorobenzene	**170**	**J**	**3.2**	=	**0.056**	**J**	0.1	U	**0.0021**	**J**	**11**	**J**	**9.7**	=	**0.054**	**J**	**0.03**	=	4.2	U	**0.032**	**J**	**61**	**J**	**2.6**	**J**	**7.6**	**J**	**34**	=	**4.1**	**J**	**1.7**	**J**	**0.0042**	**J**	**0.019**	**J**
75003	Chloroethane	35	UJ	0.079	U	0.0014	UJ	0.14	U	0.0013	UJ	5.2	U	0.088	U	0.073	U	0.0016	U	5.7	U	0.0013	UJ	0.41	U	0.066	UJ	0.089	U	2.4	U	0.086	U	0.0019	UJ	0.0016	UJ	0.0016	UJ
67663	Chloroform	19	UJ	0.043	U	0.00077	UJ	0.076	U	0.00069	UJ	2.9	UJ	0.048	UJ	0.04	UJ	0.00089	U	3.1	U	0.00069	UJ	0.23	U	0.036	UJ	0.049	UJ	1.3	U	0.047	UJ	0.0011	UJ	0.00089	UJ	0.00088	UJ
156592	cis-1,2-Dichloroethene	23	UJ	0.05	U	0.0009	UJ	0.089	U	0.00081	UJ	3.3	U	0.056	U	0.047	U	0.001	U	3.7	U	0.00081	UJ	0.26	U	0.042	UJ	0.057	U	1.5	U	0.055	U	0.0012	UJ	**0.0014**	**J**	**0.04**	**J**
1006101	cis-1,3-Dichloropropene	24	UJ	0.053	U	0.00094	UJ	0.093	U	0.00084	UJ	3.5	U	0.058	U	0.048	U	0.0011	U	3.8	U	0.00085	UJ	0.28	U	0.044	UJ	0.059	U	1.6	U	0.058	U	**0.0064**	**J**	0.0011	UJ	0.0011	UJ
100414	Ethylbenzene	43	UJ	**0.25**	**J**	0.0017	UJ	0.17	U	0.0015	UJ	**340**	=	**2.2**	=	0.087	U	0.002	U	6.9	U	0.0015	UJ	**1.9**	**J**	0.079	UJ	0.11	U	**460**	=	0.1	U	**1.1**	**J**	0.002	UJ	0.0019	UJ
108383/	m- and p-Xylenes	**74**	**J**	**0.83**	=	0.00069	UJ	**0.42**	**J**	**0.003**	**J**	**2100**	=	**0.34**	**J**	0.036	U	0.0008	UB	**9.3**	**J**	0.00063	UJ	**19**	**J**	0.033	UJ	**0.067**	**J**	**1900**	=	**0.12**	**J**	**3.7**	**J**	**0.0089**	**J**	0.00079	UJ
75092	Methylene chloride	38	UJ	0.084	U	0.0015	UJ	0.15	U	0.0014	UJ	**9**	**J**	0.093	U	**0.63**	=	0.0017	U	6.1	U	0.0014	UJ	**0.51**	**J**	0.07	UJ	**0.13**	**J**	2.5	U	0.092	U	0.0021	UJ	0.0017	UJ	0.0017	UJ
95476	o-Xylene	**330**	**J**	**2.1**	=	0.00056	UJ	**0.13**	**J**	**0.0017**	**J**	**570**	=	**0.073**	**J**	0.029	U	0.00065	UB	5.9	J	**0.00069**	**J**	**3.1**	**J**	0.026	UJ	0.036	U	**490**	=	**0.044**	**J**	**1.8**	**J**	**0.0025**	**J**	0.00064	UJ
100425	Styrene	14	UJ	0.032	U	0.00057	UJ	0.057	U	0.00052	UJ	2.1	UJ	0.036	UJ	0.03	UJ	0.00066	U	2.3	U	0.00052	UJ	0.17	U	0.027	UJ	0.036	UJ	0.97	U	0.035	UJ	**0.0064**	**J**	0.00067	UJ	0.00065	UJ
127184	Tetrachloroethene	21	UJ	0.047	U	0.00084	UJ	0.084	U	0.00076	UJ	3.1	UJ	0.053	UJ	0.044	UJ	0.00098	U	3.4	U	0.00076	UJ	0.25	U	0.04	UJ	0.053	UJ	1.4	U	0.052	UJ	0.0012	UJ	0.00098	UJ	0.00096	UJ
108883	Toluene	**5800**	**J**	**31**	**J**	**0.0023**	**J**	**1.7**	=	**0.018**	**J**	**330**	=	0.058	U	0.048	U	0.0011	U	**27**	=	**0.0017**	**J**	**29**	**J**	**0.07**	**J**	0.059	U	**820**	=	**0.086**	**J**	**2.2**	**J**	**0.0034**	**J**	0.0011	UJ
156605	trans-1,2-Dichloroethene	23	UJ	0.052	U	0.00093	UJ	0.092	U	0.00084	UJ	3.5	U	0.058	U	0.048	U	0.0011	U	3.8	U	0.00084	UJ	0.27	U	0.044	UJ	0.059	U	1.6	U	0.057	U	0.0013	UJ	0.0011	UJ	**0.0032**	**J**
1006102	trans-1,3-Dichloropropene	23	UJ	0.051	U	0.00091	UJ	0.09	U	0.00082	UJ	3.4	U	0.057	U	0.047	U	0.0011	U	3.7	U	0.00082	UJ	0.27	U	0.043	UJ	0.057	U	1.5	U	0.056	U	**0.0064**	**J**	0.0011	UJ	0.001	UJ
79016	Trichloroethene	21	UJ	0.047	U	0.00084	UJ	0.084	U	0.00076	UJ	3.1	UJ	0.053	UJ	0.044	UJ	0.00098	U	3.4	U	0.00076	UJ	0.25	U	0.04	UJ	0.053	UJ	1.4	U	0.052	UJ	0.0012	UJ	0.00098	UJ	**0.0015**	**J**
75014	Vinyl chloride	38	UJ	0.084	U	0.0015	UJ	0.15	U	0.0014	UJ	5.6	U	0.093	U	0.078	U	**0.0042**	**J**	6.1	U	0.0014	UJ	0.44	U	0.07	UJ	0.095	U	2.5	U	0.092	U	0.0021	UJ	**0.011**	**J**	**0.1**	**J**
1330207	Xylenes	**410**	**J**	**2.9**	**J**	0.0012	UJ	**0.55**	**J**	**0.0047**	**J**	**2500**	=	**0.42**	**J**	0.063	U	0.0014	UB	**15**	**J**	0.0011	UJ	**22**	**J**	0.057	UJ	**0.082**	**J**	**2400**	=	**0.17**	**J**	**5.5**	**J**	**0.011**	**J**	0.0014	UJ
SEMIVOLATILE ORGANICS (m																																							
90120	1-Methylnaphthalene	**0.14**	**J**	0.048	U	0.044	U	0.047	U	0.017	U	**0.2**	**J**	0.049	U	0.044	U	0.045	U	**0.057**	**J**	0.017	U	0.047	U	0.043	U	0.05	U	**46**	=	0.049	U	0.042	U	0.019	UJ	0.049	U
95578	2-Chlorophenol	0.051	U	0.056	U	0.051	U	0.055	U	0.02	U	0.054	U	0.057	U	0.052	U	0.052	U	0.054	U	0.019	U	0.055	U	0.05	U	0.059	U	0.54	U	0.057	U	0.049	U	0.023	UJ	0.057	U
91576	2-Methylnaphthalene	**0.24**	**J**	0.048	U	0.044	U	0.047	U	0.017	U	**0.4**	**J**	0.049	U	0.044	U	0.045	U	**0.09**	**J**	0.017	U	0.047	U	0.043	U	0.05	U	**110**	=	0.049	U	**0.14**	**J**	0.019	UJ	0.049	U
95487	2-Methylphenol (o-cresol)	**3.3**	=	**0.22**	**J**	0.05	U	0.054	U	0.02	U	0.052	U	0.056	U	0.05	U	0.051	U	0.053	U	0.019	U	0.054	U	0.049	U	0.057	U	0.52	U	0.056	U	0.048	U	0.022	UJ	0.056	U
6579496	3 & 4 Methylphenol	**3.3**	=	**0.14**	**J**	0.051	U	0.055	U	0.02	U	0.054	U	0.057	U	0.052	U	0.052	U	0.054	U	0.019	U	0.055	U	0.05	U	0.059	U	0.54	U	0.057	U	0.049	U	0.023	UJ	0.057	U
106445	4-Methylphenol (p-cresol)																																						
83329	Acenaphthene	**0.14**	**J**	0.048	U	0.044	U	0.047	U	0.017	U	**0.2**	**J**	0.049	U	0.044	U	0.045	U	0.046	U	0.017	U	0.047	U	0.043	U	0.05	U	**94**	=	0.049	U	0.042	U	0.019	UJ	0.049	U
208968	Acenaphthylene[2]	0.047	U	0.052	U	0.047	U	0.051	U	0.019	U	**0.094**	**J**	0.053	U	0.048	U	0.048	U	0.05	U	0.018	U	**0.1**	**J**	0.047	U	0.055	U	**4.6**	=	0.053	U	**0.12**	**J**	0.021	UJ	0.053	U
120127	Anthracene	**0.32**	**J**	0.065	U	0.059	U	0.065	U	0.024	U	**0.91**	=	0.067	U	0.06	U	0.061	U	**0.19**	**J**	0.023	U	**0.14**	**J**	**0.19**	**J**	0.068	U	**140**	=	0.067	U	**0.24**	**J**	0.026	UJ	0.067	U
56553	Benzo(a)anthracene	**0.41**	=	0.05	U	0.046	U	**0.082**	**J**	0.018	U	**1.3**	=	0.052	U	0.047	U	0.047	U	**1.3**	=	0.018	U	**0.41**	**J**	**1.8**	=	0.053	U	**40**	=	0.052	U	**2.2**	=	0.02	UJ	0.052	U
50328	Benzo(a)pyrene	**0.37**	**J**	0.048	U	0.044	U	0.047	U	0.017	U	**1.3**	=	0.049	U	0.044	U	0.045	U	**1.2**	=	0.017	U	**0.46**	=	**1.7**	=	0.05	U	**21**	=	0.049	U	**1.7**	=	0.019	UJ	0.049	U
205992	Benzo(b)fluoranthene	**0.57**	=	0.067	U	0.062	U	**0.12**	**J**	0.025	U	**2.4**	=	0.07	U	0.063	U	0.063	U	**1.8**	=	0.024	U	**0.89**	=	**2.6**	=	0.071	U	**34**	=	0.07	U	**2.9**	=	0.027	UJ	0.069	U
191242	Benzo(g,h,i)perylene[2]	**0.14**	**J**	0.052	U	0.047	U	0.051	U	0.019	U	**0.83**	=	0.053	U	0.048	U	0.048	U	**0.6**	=	**0.1**	**J**	**0.24**	**J**	**1.3**	=	0.055	U	**7**	=	0.053	U	**1.6**	=	**0.12**	**J**	0.053	U
207089	Benzo(k)fluoranthene	**0.17**	**J**	0.048	U	0.044	U	0.047	U	0.017	U	**0.65**	=	0.049	U	0.044	U	0.045	U	**0.52**	=	0.017	U	**0.32**	**J**	**0.73**	=	0.05	U	**11**	=	0.049	U	**0.77**	=	0.019	UJ	0.049	U
117817	Bis(2-ethylhexyl)phthalate	0.045	U	0.049	U	0.045	U	0.049	U	0.018	U	0.047	U	0.051	U	0.045	U	0.046	U	0.048	U	0.017	U	0.048	U	**0.22**	**J**	0.052	U	0.47	U	0.05	U	0.043	U	0.02	UJ	0.05	U
86748	Carbazole	**0.15**	**J**	0.049	U	0.045	U	0.049	U	0.018	U	**0.21**	**J**	0.051	U	0.045	U	0.046	U	**0.094**	**J**	0.017	U	0.048	U	**0.21**	**J**	0.052	U	**44**	=	0.05	U	**0.29**	**J**	0.02	U	0.05	U
218019	Chrysene	**0.41**	=	0.046	U	0.042	U	**0.094**	**J**	0.017	U	**1.3**	=	0.048	U	0.043	U	0.043	U	**1.3**	=	0.016	U	**0.48**	=	2	=	0.049	U	**36**	=	0.048	U	**2.4**	=	0.019	UJ	0.048	U
53703	Dibenzo(a,h)anthracene	**0.044**	**J**	0.046	U	0.042	U	0.046	U	0.017	U	**0.19**	**J**	0.048	U	0.043	U	0.043	U	**0.29**	**J**	0.016	U	**0.11**	**J**	**0.53**	=	0.049	U	**2.5**	**J**	0.048	U	**0.66**	=	0.019	UJ	0.048	U
132649	Dibenzofuran	**0.24**	**J**	0.066	U	0.061	U	0.066	U	0.024	U	**0.38**	**J**	0.068	U	0.061	U	0.062	U	0.065	U	0.023	U	0.065	U	0.06	U	0.07	U	**99**	=	0.068	U	0.058	U	0.027	U	0.068	U
84662	Diethylphthalate	0.047	U	0.052	U	0.047	U	0.051	U	0.019	U	0.05	U	0.053	U	0.048	U	0.048	U	0.05	U	0.018	U	0.051	U	0.047	U	0.055	U	0.5	U	0.053	U	0.045	U	0.021	U	0.053	U
206440	Fluoranthene	**1.2**	=	0.062	U	0.057	U	**0.2**	**J**	0.023	U	**3.3**	=	0.064	U	0.058	U	0.058	U	**1.2**	=	0.022	U	**0.99**	=	**2.4**	=	0.066	U	**220**	=	**0.076**	**J**	**3.2**	=	0.025	U	0.064	U
86737	Fluorene	**0.49**	=	0.064	U	0.058	U	0.063	U	0.023	U	**0.93**	=	0.066	U	0.059	U	0.059	U	**0.074**	**J**	0.022	U	0.063	U	0.057	U	0.067	U	**170**	=	0.065	U	**0.11**	**J**	0.026	U	0.065	U
193395	Indeno(1,2,3-cd)pyrene	**0.11**	**J**	0.048	U	0.044	U	0.047	U	0.017	U	**0.66**	=	0.049	U	0.044	U	0.045	U	**0.43**	=	**0.11**	**J**	**0.24**	**J**	**1.2**	=	0.05	U	**5.5**	=	0.049	U	**1.5**	=	**0.11**	**J**	0.049	U
91203	Naphthalene	**0.92**	=	0.048	U	0.044	U	**0.19**	**J**	0.017	U	**1.8**	=	**0.06**	**J**	0.044	U	0.045	U	**0.33**	**J**	0.017	U	**0.65**	=	**0.16**	**J**	**0.23**	**J**	**490**	=	**0.074**	**J**	**0.25**	**J**	0.019	U	0.049	U
85018	Phenanthrene[2]	**1.5**	=	0.06	U	0.055	U	**0.1**	**J**	0.022	U	**4.1**	=	0.062	U	0.055	U	0.056	U	**0.68**	=	0.021	U	**0.53**	=	**0.81**	=	**0.14**	**J**	**440**	=	**0.16**	**J**	**1.2**	=	0.024	U	0.061	U
108952	Phenol	**0.82**	=	**0.24**	**J**	**0.055**	**J**	0.047	U	**0.048**	**J**	0.046	U	0.049	U	0.044	U	0.045	U	**0.13**	**J**	0.017	U	0.047	U	0.043	U	0.05	U	0.46	U	0.049	U	0.042	U	0.019	U	0.049	U
129000	Pyrene	**0.95**	=	0.061	U	0.056	U	**0.18**	**J**	0.022	U	**3**	=	0.063	U	0.057	U	0.057	U	**1.1**	=	0.021	U	**0.64**	=	**2.2**	=	0.064	U	**160**	=	**0.063**	**J**	**3.1**	=	0.025	U	0.062	U

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0030 (5-7 ft) 18-Jan-08	CM-SB0030 (7-9 ft) 18-Jan-08	CM-SB0031 (17-19 ft) 18-Jan-08	CM-SB0031 (2-4 ft) 18-Jan-08	CM-SB0031 (6-8 ft) 18-Jan-08	CM-SB0032 (2-4 ft) 14-Jan-08	CM-SB0032 (7-9) 14-Jan-08	CM-SB0033 (12-14 ft) 14-Jan-08	CM-SB0033 (8-10 ft) 14-Jan-08	CM-SB0033 (2-4 ft) 14-Jan-08	CM-SB0034 (14-16 ft) 18-Jan-08	CM-SB0034 (2-4 ft) 18-Jan-08	CM-SB0034 (6-8 ft) 18-Jan-08	CM-SB0035 (14-16 ft) 14-Jan-08	CM-SB0035 (2-4 ft) 14-Jan-08	CM-SB0035 (6-8 ft) 14-Jan-08	CM-SB0036 (2-4 ft) 18-Jan-08	CM-SB0036 (6-8 ft) 18-Jan-08	CM-SB0036 (9-11 ft) 18-Jan-08
INORGANICS (mg/kg)																				
7440360	Antimony, Total																			
7440382	Arsenic, Total																			
7440393	Barium, Total																			
7440417	Beryllium, Total																			
7440439	Cadmium, Total																			
7440473	Chromium, Total																			
7440508	Copper, Total																			
7439921	Lead, Total																			
7440020	Nickel, Total																			
7782492	Selenium, Total																			
7440280	Thallium, Total																			
7440666	Zinc, Total																			
57125	Cyanide, Total																			

result — COPC = chemical of potential concern
ult — SSL = groundwater protection soil screening level (Arcadis & CH2MHill, 2009)
iemical concentration.
gional Screening Levels (RSLs).
iis chemical; hence, the RSL for pyrene is used as a surrogate concentration.
ecause the maximum concentration exceeds the RSL
because the maximum concentration does not exceed the RSL
ed as a COPC because there is no published RSL
ecause it is included in the group of potentially carcinogenic PAHs,
is exceeded its screening level.
)15, RSL table.

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0037 (2-4) (2-4 ft) 17-Jan-08		CM-SB0037 (8-10 ft) 17-Jan-08		CM-SB0038 (2-4 ft) 18-Jan-08		CM-SB0038 (5-7 ft) 18-Jan-08		CM-SB0039 (2-4 ft) 17-Jan-08		CM-SB0039 (7-9 ft) 17-Jan-08		CM-SB0040 (2-4 ft) 17-Jan-08		CM-SB0040 (6-8 ft) 17-Jan-08		CM-SB0040 (8-10 ft) 17-Jan-08		CM-SB0041 (2-4 ft) 17-Jan-08		CM-SB0041 (6-8 ft) 17-Jan-08		CM-SB0042 (2-4 ft) 17-Jan-08		CM-SB0042 (6-8 ft) 17-Jan-08		CM-SB0043 (2-4 ft) 17-Jan-08		CM-SB0043 (5-7 ft) 17-Jan-08		CM-SB0044 (2-4 ft) 16-Jan-08		CM-SB0044 (7-9 ft) 16-Jan-08		CM-SB0045 (7-9 ft) 16-Jan-08		CM-SB0046 (14-16 ft) 18-Jan-08		CM-SB0046 (2-4 ft) 18-Jan-08		CM-SB0046 (8-10 ft) 18-Jan-08	
VOLATILE ORGANICS (mg/kg)																																											
79005	1,1,2-Trichloroethane	0.0012	UJ	0.0014	U	0.0016	UJ	0.061	U	0.067	U	0.0013	UJ	0.046	U	0.0013	UJ	0.0013	UJ	0.001	UJ	0.0013	UJ	0.00092	UJ	0.0014	UJ	0.0013	UJ	0.0015	UJ	0.058	U	0.0013	U	0.085	U	0.0012	UJ	0.2	UJ	0.0012	UJ
120821	1,2,4-Trichlorobenzene	0.051	UJ	0.058	UJ	0.055	U	0.055	U	0.051	U	0.058	UJ	0.049	U	0.057	U	0.058	U	0.048	UJ	0.055	UJ	0.048	U	0.058	UJ	0.048	U	0.058	UJ	0.049	U	0.058	U	0.056	UJ	0.06	U	0.058	U	0.053	U
107062	1,2-Dichloroethane	0.002	UJ	0.0023	U	0.0027	UJ	0.1	U	0.11	U	0.0022	UJ	0.077	U	0.0021	UJ	0.0022	UJ	0.0017	UJ	0.0022	UJ	0.0015	UJ	0.0024	UJ	0.0021	UJ	0.0024	UJ	0.097	U	0.0021	U	0.14	U	**0.0052**	**J**	0.34	UJ	0.0019	UJ
78875	1,2-Dichloropropane	0.0012	UJ	0.0014	U	0.0016	UJ	0.061	U	0.067	U	0.0013	UJ	**1.3**	=	0.0013	UJ	0.0013	UJ	0.001	UJ	0.0013	UJ	0.00092	UJ	0.0014	UJ	0.0013	UJ	0.0015	UJ	0.058	U	0.0013	U	0.085	U	0.0012	UJ	0.2	UJ	0.0012	UJ
106467	1,4-Dichlorobenzene	0.042	UJ	0.048	UJ	0.046	U	0.046	U	0.043	U	0.048	UJ	0.041	U	0.047	U	0.048	U	0.04	UJ	0.046	UJ	0.04	U	0.048	UJ	0.04	U	0.049	UJ	0.041	U	0.048	U	0.047	UJ	0.05	U	0.048	U	0.044	U
78933	2-Butanone (MEK)	0.011	UJ	0.013	UJ	0.015	UJ	0.55	U	0.61	U	0.012	UJ	0.42	U	0.012	UJ	0.012	UJ	0.0095	UJ	0.012	UJ	0.0085	UJ	0.013	UJ	0.012	UJ	0.013	UJ	0.53	U	0.012	U	0.78	U	0.011	UJ	1.9	UJ	0.011	UJ
67641	Acetone	**0.034**	**JJ**	0.0058	UB	**0.032**	**J**	**0.43**	**J**	**0.45**	**J**	0.0055	UJ	**0.28**	**J**	0.0054	UJ	0.0056	UJ	0.0044	UJ	0.0056	UJ	0.0039	UJ	0.0061	UJ	0.0054	UJ	0.0062	UJ	0.25	U	**0.0072**	**J**	0.36	U	**0.03**	**J**	**2.5**	**J**	**0.013**	**J**
71432	Benzene	**0.12**	**J**	**0.0034**	**J**	**0.0015**	**J**	0.055	U	**3.5**	=	**0.0012**	**J**	**0.53**	=	**0.041**	**J**	**0.004**	**J**	0.00095	UJ	0.0012	UJ	**0.00093**	**J**	0.0013	UJ	**0.0024**	**J**	0.0013	UJ	**0.063**	**J**	0.0012	U	**0.31**	**J**	**0.11**	**J**	**9.4**	**J**	**0.52**	**J**
75150	Carbon disulfide	**0.0057**	**J**	**0.031**	**J**	**0.0013**	**J**	0.039	U	0.043	U	0.00084	UJ	**0.57**	=	**0.0023**	**J**	0.00086	UJ	**0.0066**	**J**	**0.0018**	**J**	0.0006	UJ	0.00093	UJ	**0.0013**	**J**	0.00095	UJ	0.038	U	**0.00093**	**J**	**0.062**	**J**	**0.0038**	**J**	0.13	UJ	0.00076	UJ
56235	Carbon tetrachloride	0.0014	UJ	0.0016	U	**0.0019**	**J**	0.071	U	0.078	U	0.0015	UJ	**0.35**	=	0.0015	UJ	0.0016	UJ	0.0012	UJ	0.0015	UJ	0.0011	UJ	0.0017	UJ	0.0015	UJ	0.0017	UJ	0.068	U	0.0015	U	0.1	U	0.0015	UJ	0.24	UJ	0.0014	UJ
108907	Chlorobenzene	0.0011	UJ	**0.0035**	**J**	0.0015	UJ	**4.2**	=	0.061	U	0.0012	UJ	0.042	U	**0.0014**	**J**	**0.0016**	**J**	0.00095	UJ	0.0012	UJ	0.00085	UJ	0.0013	UJ	0.0012	UJ	0.0013	UJ	0.053	U	0.0012	U	**0.12**	**J**	0.0011	UJ	0.19	UJ	0.0011	UJ
75003	Chloroethane	0.0015	UJ	0.0017	U	0.002	UJ	0.076	U	0.083	U	0.0016	UJ	0.057	U	0.0016	UJ	0.0017	UJ	0.0013	UJ	0.0017	UJ	0.0012	UJ	0.0018	UJ	0.0016	UJ	0.0018	UJ	0.073	U	0.0016	U	0.11	UJ	0.0016	UJ	0.25	UJ	0.0015	UJ
67663	Chloroform	0.00082	UJ	0.00093	U	**0.0017**	**J**	0.041	U	0.046	U	0.00089	UJ	0.031	U	0.00086	UJ	0.00091	UJ	0.00071	UJ	0.00091	UJ	0.00063	UJ	0.00098	UJ	0.00087	UJ	0.001	UJ	0.04	U	0.00086	U	0.058	U	0.00085	UJ	0.14	UJ	0.00079	UJ
156592	cis-1,2-Dichloroethene	0.00096	UJ	0.0011	U	0.0013	UJ	0.048	U	0.053	U	**0.0011**	**J**	0.037	U	0.001	UJ	0.0011	UJ	0.00083	UJ	0.0011	UJ	0.00074	UJ	0.0012	UJ	0.001	UJ	0.0012	UJ	0.047	U	0.001	U	**4.9**	=	0.001	UJ	0.16	UJ	0.00093	UJ
1006101	cis-1,3-Dichloropropene	0.001	U	0.0011	U	0.0013	UJ	0.05	U	0.056	U	0.0011	UJ	0.038	U	0.0011	UJ	0.0011	UJ	0.00086	UJ	0.0011	UJ	0.00077	UJ	0.0012	UJ	0.0011	UJ	0.0012	UJ	0.049	U	0.0011	U	0.071	U	0.001	UJ	0.17	UJ	0.00097	UJ
100414	Ethylbenzene	0.0018	UJ	0.0021	U	0.0024	UJ	0.091	U	0.1	U	0.0019	UJ	0.069	U	0.0019	UJ	0.002	UJ	0.0016	UJ	0.002	UJ	0.0014	UJ	0.0022	UJ	0.0019	UJ	0.0022	UJ	**0.8**	=	0.0019	U	0.13	U	**0.01**	**J**	**26**	**J**	**0.0018**	**J**
108383/	m- and p-Xylenes	0.00074	U	0.00084	U	**0.0025**	**J**	0.037	U	**0.099**	**J**	0.0008	UJ	0.028	U	0.00078	UJ	0.00082	UJ	**0.0015**	**J**	0.00082	UJ	0.00057	UJ	0.00089	UJ	0.00078	UJ	0.0009	UJ	**0.59**	=	0.00078	U	**0.12**	**J**	0.00077	UJ	**6.9**	**J**	**0.0087**	**J**
75092	Methylene chloride	0.0016	UJ	0.0018	U	0.0021	UJ	**0.18**	**J**	**0.15**	**J**	0.0017	UJ	**0.11**	**J**	0.0017	UJ	0.0018	UJ	0.0014	UJ	0.0018	UJ	**0.0016**	**J**	0.0019	UJ	0.0017	UJ	0.002	UJ	0.078	U	0.0017	U	0.11	U	0.0017	UJ	0.27	UJ	0.0015	UJ
95476	o-Xylene	0.0006	UJ	0.00068	U	0.0008	UJ	0.03	U	**0.052**	**J**	0.00065	UJ	0.023	U	0.00063	UJ	0.00066	UJ	0.00052	UJ	0.00066	UJ	0.00046	UJ	0.00072	UJ	0.00063	UJ	0.00073	UJ	**0.1**	**J**	0.00063	U	**0.048**	**J**	**0.00096**	**J**	**14**	**J**	**0.0068**	**J**
100425	Styrene	0.00061	UJ	0.0007	U	0.00082	UJ	0.031	U	0.034	U	0.00066	UJ	0.023	U	0.00064	UJ	0.00068	UJ	0.00053	UJ	0.00067	UJ	0.00047	UJ	0.00073	UJ	0.00064	UJ	0.00075	UJ	0.03	U	0.00064	U	0.043	U	0.00063	UJ	0.1	UJ	0.00059	UJ
127184	Tetrachloroethene	0.0009	UJ	0.001	U	**0.0012**	**J**	0.045	U	0.05	U	0.00097	UJ	0.034	U	0.00095	UJ	0.001	UJ	0.00078	UJ	0.001	UJ	0.00069	UJ	0.0011	UJ	0.00095	UJ	0.0011	UJ	0.044	U	0.00095	U	**0.55**	=	0.00093	UJ	0.15	UJ	0.00087	UJ
108883	Toluene	0.001	UJ	0.0011	U	**0.0018**	**J**	0.05	U	**0.27**	**J**	0.0011	UJ	0.038	U	0.0011	UJ	0.0011	UJ	0.00086	UJ	0.0011	UJ	**0.002**	**J**	0.0012	UJ	0.0011	UJ	**0.0019**	**J**	**0.23**	**J**	0.0011	U	**0.28**	**J**	0.001	UJ	**0.57**	**J**	**0.002**	**J**
156605	trans-1,2-Dichloroethene	0.00099	UJ	0.0011	U	**0.0021**	**J**	0.05	U	0.055	U	0.0011	UJ	0.038	U	0.001	UJ	0.0011	UJ	0.00085	UJ	0.0011	UJ	0.00076	UJ	0.0012	UJ	0.001	UJ	0.0012	UJ	0.048	U	0.001	U	**0.61**	=	0.001	UJ	0.17	UJ	0.00096	UJ
1006102	trans-1,3-Dichloropropene	0.00097	U	0.0011	U	0.0013	UJ	0.049	U	0.054	U	0.001	UJ	0.037	U	0.001	UJ	0.0011	UJ	0.00084	UJ	0.0011	UJ	0.00075	UJ	0.0012	UJ	0.001	UJ	0.0012	UJ	0.047	U	0.001	U	0.069	U	0.001	UJ	0.16	UJ	0.00094	UJ
79016	Trichloroethene	0.0009	UJ	0.001	UJ	**0.0014**	**J**	0.045	U	0.05	UJ	0.00097	UJ	0.034	UJ	0.00095	UJ	0.001	UJ	0.00078	UJ	0.001	UJ	0.00069	UJ	0.0011	UJ	0.00095	UJ	0.0011	UJ	0.044	U	0.00095	U	**0.44**	=	0.00093	UJ	0.15	UJ	0.00087	UJ
75014	Vinyl chloride	0.0016	UJ	0.0018	U	0.0021	UJ	0.081	U	0.089	U	**0.0046**	**J**	0.061	U	**0.0089**	**J**	**0.005**	**J**	0.0014	UJ	0.0018	UJ	0.0012	UJ	0.0019	UJ	0.0017	UJ	0.002	UJ	0.078	U	0.0017	U	**3.3**	=	0.0017	UJ	0.27	UJ	0.0015	UJ
1330207	Xylenes	0.0013	UJ	0.0015	U	**0.0032**	**J**			**0.15**	**J**	0.0014	UJ	0.05	U	0.0014	UJ	0.0014	UJ	**0.0019**	**J**	0.0014	UJ	0.001	UJ	0.0016	UJ	0.0014	UJ	0.0016	UJ	**0.69**	=	0.0014	U	**0.16**	**J**	0.0013	UJ	**21**	**J**	**0.015**	**J**
SEMIVOLATILE ORGANICS (m																																										
90120	1-Methylnaphthalene	**0.6**	**J**	0.049	UJ	**0.05**	**J**	0.047	U	0.044	U	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	**0.1**	**J**	0.05	UJ	**0.059**	**J**	0.049	U	**0.052**	**J**	0.051	U	0.05	U	0.045	U
95578	2-Chlorophenol	0.051	U	0.058	U	0.055	U	0.055	U	0.051	U	0.058	U	0.049	U	0.057	U	0.058	U	0.048	U	0.055	U	0.048	U	0.058	U	0.048	U	0.058	U	0.049	U	0.058	U	0.056	UJ	0.06	U	0.058	U	0.053	U
91576	2-Methylnaphthalene	**0.56**	**J**	0.049	UJ	**0.092**	**J**	0.047	U	0.044	U	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	**0.14**	**J**	0.05	UJ	**0.075**	**J**	0.049	U	**0.059**	**J**	0.051	U	0.05	U	0.045	U
95487	2-Methylphenol (o-cresol)	0.05	U	0.056	U	0.054	U	0.054	U	0.05	U	0.057	U	0.048	U	0.056	U	0.057	U	0.047	U	0.054	U	0.047	U	0.056	U	0.047	U	0.057	U	0.048	U	0.056	U	0.055	UJ	0.058	U	0.057	U	0.052	U
6579496	3 & 4 Methylphenol	0.051	U	0.058	U	0.055	U	0.055	U	0.051	U	0.058	U	0.049	U	0.057	U	0.058	U	0.048	U	0.055	U	0.048	U	0.058	U	0.048	U	0.058	U	0.049	U	0.058	U	0.056	UJ	0.06	U	0.058	U	0.053	U
106445	4-Methylphenol (p-cresol)																																									
83329	Acenaphthene	**0.31**	**J**	0.049	U	0.047	U	0.047	U	0.044	U	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	0.041	U	0.05	UJ	**0.1**	**J**	0.049	U	**0.072**	**J**	0.051	U	0.05	U	0.045	U
208968	Acenaphthylene[2]	**0.28**	**J**	0.054	U	0.051	U	0.051	U	0.048	U	0.054	UJ	0.045	U	0.053	U	0.054	U	0.045	UJ	0.051	UJ	0.045	U	0.054	UJ	0.045	U	0.054	UJ	**0.067**	**J**	0.054	U	**0.056**	**J**	0.056	U	0.054	U	0.049	U
120127	Anthracene	**0.72**	**J**	0.067	U	**0.53**	=	0.064	U	0.06	U	0.068	UJ	0.057	U	0.066	U	0.068	U	0.057	UJ	0.064	UJ	0.056	U	0.067	UJ	**0.13**	**J**	0.068	UJ	**0.61**	=	0.067	U	**0.15**	**J**	0.07	U	0.068	U	0.062	U
56553	Benzo(a)anthracene	**2.9**	**J**	0.052	UJ	**0.48**	=	0.05	U	**0.44**	=	0.053	UJ	0.044	U	0.052	U	0.053	U	0.044	UJ	0.05	UJ	0.044	U	0.052	UJ	**0.43**	=	0.053	UJ	**3.1**	=	0.052	U	**0.79**	**J**	0.054	U	0.053	U	0.048	U
50328	Benzo(a)pyrene	0.044	UJ	0.049	UJ	0.047	U	0.047	U	**0.55**	=	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	0.041	U	0.05	UJ	**3.4**	=	0.049	U	**0.95**	**J**	0.051	U	0.05	U	0.045	U
205992	Benzo(b)fluoranthene	0.062	UJ	0.07	UJ	0.067	U	0.067	U	**0.94**	=	0.071	UJ	0.059	U	0.069	U	0.071	U	0.059	UJ	0.067	UJ	0.058	U	0.07	UJ	**0.78**	=	0.071	UJ	**6.3**	=	0.07	U	**1.4**	**J**	**0.72**	=	0.071	U	0.064	U
191242	Benzo(g,h,i)perylene[2]	**2.4**	**J**	0.054	UJ	**0.19**	**J**	**0.16**	**J**	**0.26**	**J**	0.054	UJ	0.045	U	0.053	U	0.054	U	0.045	UJ	0.051	UJ	0.045	U	0.054	UJ	**0.21**	**J**	0.054	UJ	**2.4**	=	0.054	U	**0.58**	**J**	**0.18**	**J**	0.054	U	0.049	U
207089	Benzo(k)fluoranthene	0.044	UJ	0.049	UJ	0.047	U	0.047	U	**0.27**	**J**	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	**0.26**	**J**	0.05	UJ	**1.6**	=	0.049	U	**0.43**	**J**	**0.22**	**J**	0.05	U	0.045	U
117817	Bis(2-ethylhexyl)phthalate	0.045	UJ	0.051	UJ	0.049	U	0.048	U	0.045	U	0.051	UJ	0.043	U	0.05	U	0.051	U	0.043	UJ	0.049	UJ	0.042	U	0.051	UJ	0.043	U	0.051	UJ	0.044	U	0.051	U	0.05	UJ	0.053	U	0.051	U	0.047	U
86748	Carbazole	**0.99**	**J**	0.051	UJ	**0.14**	**J**	0.048	U	0.045	U	0.051	UJ	0.043	U	0.05	U	0.051	U	0.043	UJ	0.049	UJ	0.042	U	0.051	UJ	0.043	U	0.051	UJ	**0.37**	**J**	0.051	U	0.05	UJ	0.053	U	0.051	U	0.047	U
218019	Chrysene	**3.1**	**J**	0.048	UJ	**0.66**	=	0.046	U	**0.48**	=	0.048	UJ	0.041	U	0.047	U	0.048	U	0.04	UJ	0.046	UJ	0.04	U	0.048	UJ	**0.58**	=	0.049	UJ	**3.2**	=	0.048	U	**0.87**	**J**	**0.27**	**J**	0.048	U	0.044	U
53703	Dibenzo(a,h)anthracene	0.042	UJ	0.048	UJ	0.046	U	**0.22**	**J**	0.043	U	0.048	UJ	0.041	U	0.047	U	0.048	U	0.04	UJ	0.046	UJ	0.04	U	0.048	UJ	0.04	U	0.049	UJ	**0.96**	=	0.048	U	**0.21**	**J**	0.05	U	0.048	U	0.044	U
132649	Dibenzofuran	**0.36**	**J**	0.069	UJ	**0.2**	**J**	0.065	U	0.061	U	0.069	UJ	0.058	U	0.068	U	0.069	U	0.058	UJ	0.066	UJ	0.057	U	0.069	UJ	0.057	U	0.069	UJ	**0.15**	**J**	0.069	U	0.067	UJ	0.071	U	0.069	U	0.063	U
84662	Diethylphthalate	0.047	UJ	0.054	UJ	0.051	U	0.051	U	0.048	U	0.054	UJ	0.045	U	0.053	U	0.054	U	0.045	UJ	0.051	UJ	0.045	U	0.054	UJ	0.045	U	0.054	UJ	0.046	U	0.054	U	0.052	UJ	0.056	U	0.054	U	0.049	U
206440	Fluoranthene	**4.4**	**J**	0.065	UJ	**1.9**	=	0.061	U	**0.48**	=	0.065	UJ	0.055	U	0.064	U	0.065	U	0.054	UJ	0.062	UJ	0.054	U	0.065	UJ	**0.64**	=	0.065	UJ	**4.2**	=	0.065	U	**0.83**	**J**	**0.15**	**J**	0.065	U	0.059	U
86737	Fluorene	**0.91**	**J**	0.066	UJ	0.063	U	0.063	U	0.059	U	0.066	UJ	0.056	U	0.065	U	0.066	U	0.055	UJ	0.063	UJ	0.055	U	0.066	UJ	0.055	U	0.067	UJ	0.056	U	0.066	U	**0.11**	**J**	0.068	U	0.066	U	0.06	U
193395	Indeno(1,2,3-cd)pyrene	**1.5**	**J**	0.049	UJ	**0.13**	**J**	**0.17**	**J**	**0.16**	**J**	0.05	UJ	0.042	UJ	0.049	UJ	0.05	UJ	0.042	UJ	0.047	UJ	0.041	UJ	0.049	UJ	**0.13**	**J**	0.05	UJ	**1.4**	=	0.049	U	**0.46**	**J**	**0.21**	**J**	0.05	U	0.045	U
91203	Naphthalene	**2.9**	**J**	0.049	UJ	**0.2**	**J**	0.047	U	0.044	U	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	**0.16**	**J**	0.05	UJ	**0.17**	**J**	0.049	U	**0.41**	**J**	0.051	U	0.05	U	0.045	U
85018	Phenanthrene[2]	**2.8**	**J**	0.062	UJ	**2**	=	0.059	U	**0.2**	**J**	0.062	UJ	0.052	U	0.061	U	0.062	U	0.052	UJ	0.059	UJ	0.052	U	0.062	UJ	**0.55**	=	0.063	UJ	**2.4**	=	0.062	U	**0.57**	**J**	0.064	U	0.062	U	0.057	U
108952	Phenol	**0.089**	**J**	0.049	U	0.047	U	0.047	U	**0.36**	**J**	0.05	U	0.042	U	0.049	U	**0.21**	**J**	0.042	U	0.047	U	0.041	U	0.049	U	0.041	U	0.05	U	**0.11**	**J**	0.049	U	**0.14**	**J**	0.051	U	0.05	U	0.045	U
129000	Pyrene	**4.7**	**J**	0.063	UJ	**1.2**	=	0.06	U	**0.58**	**J**	0.064	UJ	0.053	UJ	0.062	UJ	0.064	UJ	0.053	UJ	0.061	UJ	0.053	UJ	0.063	UJ	**0.92**	**J**	0.064	UJ	**4.9**	=	0.063	U	**0.72**	**J**	**0.12**	**J**	0.064	U	0.058	U

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0037 (2-4) (2-4 ft) 17-Jan-08	CM-SB0037 (8-10 ft) 17-Jan-08	CM-SB0038 (2-4 ft) 18-Jan-08	CM-SB0038 (5-7 ft) 18-Jan-08	CM-SB0039 (2-4 ft) 17-Jan-08	CM-SB0039 (7-9 ft) 17-Jan-08	CM-SB0040 (2-4 ft) 17-Jan-08	CM-SB0040 (6-8 ft) 17-Jan-08	CM-SB0040 (8-10 ft) 17-Jan-08	CM-SB0041 (2-4 ft) 17-Jan-08	CM-SB0041 (6-8 ft) 17-Jan-08	CM-SB0042 (2-4 ft) 17-Jan-08	CM-SB0042 (6-8 ft) 17-Jan-08	CM-SB0043 (2-4 ft) 17-Jan-08	CM-SB0043 (5-7 ft) 17-Jan-08	CM-SB0044 (2-4 ft) 16-Jan-08	CM-SB0044 (7-9 ft) 16-Jan-08	CM-SB0045 (7-9 ft) 16-Jan-08	CM-SB0046 (14-16 ft) 18-Jan-08	CM-SB0046 (2-4 ft) 18-Jan-08	CM-SB0046 (8-10 ft) 18-Jan-08
INORGANICS (mg/kg)																						
7440360	Antimony, Total																					
7440382	Arsenic, Total																					
7440393	Barium, Total																					
7440417	Beryllium, Total																					
7440439	Cadmium, Total																					
7440473	Chromium, Total																					
7440508	Copper, Total																					
7439921	Lead, Total																					
7440020	Nickel, Total																					
7782492	Selenium, Total																					
7440280	Thallium, Total																					
7440666	Zinc, Total																					
57125	Cyanide, Total																					

U = qualifier code for nondetected result
J = qualifier code for estimated result
COPC = chemical of potential concern
SSL = groundwater protection soil screening level (Arcadis & CH2MHill, 2009)

BOLD font indicates a detected chemical concentration.

1 = USEPA, November 2015. Regional Screening Levels (RSLs).

2 = No published RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate concentration.

3 = chemical retained as a COPC because the maximum concentration exceeds the RSL

4 = chemical excluded as a COPC because the maximum concentration does not exceed the RSL

5 = chemical conservatively retained as a COPC because there is no published RSL

6 = chemical retained as a COPC because it is included in the group of potentially carcinogenic PAHs, and at least one in that group has exceeded its screening level.

7 = Source: USEPA, November 2015, RSL table.

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0047 (2-4 ft) 16-Jan-08		CM-SB0047 (6-8 ft) 16-Jan-08		CM-SB0048 (12-14 ft) 18-Jan-08		CM-SB0048 (2-4 ft) 18-Jan-08		CM-SB0048 (6-8 ft) 18-Jan-08		CM-SB0049 (2-4 ft) 16-Jan-08		CM-SB0049 (6-8 ft) 16-Jan-08		CM-SB0049 (9-11 ft) 16-Jan-08		CM-SB0050 (2-4 ft) 16-Jan-08		CM-SB0050 (6-8 ft) 16-Jan-08		CM-SB0050 (9-11 ft) 16-Jan-08		CM-SB0051 (2-4 ft) 16-Jan-08		CM-SB0051 (7-9 ft) 16-Jan-08		CM-SB0052 (2-4 ft) 16-Jan-08		CM-SB0052 (8-10 ft) 16-Jan-08		CM-SB0053 (2-4 ft) 17-Jan-08		CM-SB0053 (7-9) 17-Jan-08		CM-SB0054 (2-4 ft) 17-Jan-08		CM-SB0054 (6-8 ft) 17-Jan-08		CM-SB0055 (2-4 ft) 15-Jan-08		CM-SB0056 (2-4 ft) 16-Jan-08	
VOLATILE ORGANICS (mg/kg)																																													
79005	1,1,2-Trichloroethane	0.13	UJ	0.0015	U	1.2	UJ	0.0017	UJ	0.052	UJ	0.0013	UJ	0.0013	U	0.0014	U	0.053	U	0.0011	U	0.0012	U	0.0012	U	0.0013	U	0.0014	U	0.0011	U	0.077	UJ	0.0012	UJ	0.0016	U	0.0016	U	0.0015	UJ	0.072	U
120821	1,2,4-Trichlorobenzene	0.25	U	0.059	U	0.054	U	0.049	U	0.05	U	0.053	U	0.058	U	0.058	U	0.047	U	0.056	U	0.056	U	0.055	U	0.057	U	0.055	U	0.054	U	0.022	U	0.021	U	0.022	U	0.023	U	0.051	U	**0.038**	**J**
107062	1,2-Dichloroethane	0.22	UJ	0.0024	U	2.1	UJ	0.0029	UJ	0.087	UJ	0.0021	UJ	0.0022	U	0.0023	U	0.088	U	0.0019	U	0.002	U	0.0019	U	0.0021	U	0.0024	U	0.0018	U	0.13	UJ	0.0021	UJ	0.0026	U	0.0027	U	0.0025	UJ	0.12	U
78875	1,2-Dichloropropane	0.13	UJ	0.0015	U	1.2	UJ	0.0017	UJ	0.052	UJ	0.0013	UJ	0.0013	U	0.0014	U	0.053	U	0.0011	U	0.0012	U	0.0012	U	0.0013	U	0.0014	U	0.0011	U	0.077	UJ	0.0012	UJ	0.0016	U	0.0016	U	0.0015	UJ	0.072	U
106467	1,4-Dichlorobenzene	0.21	U	0.049	U	0.045	U	0.041	U	0.041	U	0.044	U	0.049	U	0.048	U	0.04	U	0.047	U	0.047	U	0.046	U	0.048	U	0.046	U	0.045	U	0.019	U	0.018	U	0.018	U	0.019	U	0.043	U	0.0085	U
78933	2-Butanone (MEK)	1.2	UJ	0.013	U	11	UJ	0.016	UJ	0.48	UJ	0.011	UJ	0.012	U	0.013	U	0.48	U	0.01	U	0.011	U	**0.024**	**J**	0.011	U	0.013	U	0.0097	U	0.71	UJ	0.011	UJ	0.014	U	0.015	U	0.013	UJ	0.66	U
67641	Acetone	**6.9**	**J**	**0.011**	**J**	5.3	UJ	**0.015**	**J**	0.22	UJ	**0.02**	**J**	0.0055	U	0.0058	U	0.22	U	0.0048	UB	0.0051	U	**0.037**	**J**	**0.013**	**J**	0.0061	U	0.0045	UB	0.33	UJ	0.0053	UJ	**0.021**	**J**	0.007	U	**0.12**	**J**	0.3	U
71432	Benzene	**22**	**J**	**0.0028**	**J**	**4.4**	**J**	**0.0073**	**J**	**0.12**	**J**	**0.0012**	**J**	0.0012	U	0.0013	U	**0.06**	**J**	**0.18**	=	**0.29**	=	**0.004**	**J**	**0.0046**	**J**	**0.013**	=	**0.011**	=	**0.53**	**J**	**0.0026**	**J**	**0.019**	=	**0.0045**	**J**	**0.008**	**J**	**0.066**	**J**
75150	Carbon disulfide	0.086	UJ	**0.0046**	**J**	0.81	UJ	**0.0033**	**J**	0.034	UJ	**0.003**	**J**	0.00084	U	**0.0033**	**J**	**0.07**	**J**	0.00073	U	**0.00086**	**J**	**0.0059**	=	**0.0082**	=	**0.01**	=	0.00069	U	0.05	UJ	0.0008	UJ	**0.007**	=	0.0011	U	0.00096	UJ	0.047	U
56235	Carbon tetrachloride	0.15	UJ	0.0017	U	1.5	UJ	0.002	UJ	0.061	UJ	0.0015	UJ	0.0015	U	0.0016	U	0.061	U	0.0013	U	0.0014	U	0.0014	U	0.0015	U	0.0017	U	0.0012	U	0.09	UJ	0.0014	UJ	0.0018	U	0.0019	U	0.0017	UJ	0.084	U
108907	Chlorobenzene	0.12	UJ	0.0013	U	**18**	**J**	0.0016	UJ	**1.7**	**J**	0.0011	UJ	0.0012	U	0.0013	U	0.048	U	0.001	U	0.0011	U	0.0011	U	0.0011	U	0.0013	U	0.00097	U	**0.79**	**J**	0.0011	UJ	0.0014	U	**0.0023**	**J**	**0.036**	**J**	0.066	U
75003	Chloroethane	0.17	UJ	0.0018	U	1.6	UJ	0.0021	UJ	0.066	UJ	0.0016	UJ	0.0016	U	0.0017	U	0.066	U	0.0014	U	0.0015	U	0.0015	U	0.0016	U	0.0018	U	0.0013	U	0.096	UJ	0.0015	UJ	0.002	U	0.0021	U	0.0018	UJ	0.089	U
67663	Chloroform	0.091	UJ	0.001	U	0.85	UJ	0.0012	UJ	0.036	UJ	0.00085	UJ	0.00089	U	0.00094	U	0.036	U	0.00077	U	0.00082	U	0.00079	U	0.00086	U	0.00099	U	0.00072	U	0.053	UJ	0.00085	UJ	0.0011	U	0.0011	U	0.001	UJ	0.049	U
156592	cis-1,2-Dichloroethene	0.11	UJ	0.0012	U	1	UJ	0.0014	UJ	0.042	UJ	0.001	UJ	0.001	U	0.0011	U	0.042	U	**0.0058**	=	**0.14**	=	**0.0015**	**J**	**0.023**	**J**	0.0012	U	**0.023**	=	**0.21**	**J**	0.00099	UJ	0.0013	U	**0.15**	=	0.0012	UJ	0.057	U
1006101	cis-1,3-Dichloropropene	0.11	UJ	0.0012	U	1	UJ	0.0014	UJ	0.044	UJ	0.001	UJ	0.0011	U	0.0011	U	0.044	U	0.00094	U	0.001	U	0.00097	U	0.001	U	0.0012	U	0.00088	U	0.064	UJ	0.001	UJ	0.0013	U	0.0014	U	0.0012	UJ	0.06	U
100414	Ethylbenzene	**0.81**	**J**	0.0022	U	**3**	**J**	**0.0054**	**J**	0.079	UJ	0.0019	UJ	0.0019	U	0.0021	U	0.079	U	**0.014**	=	**0.0077**	=	0.0017	U	0.0019	U	0.0022	U	0.0016	U	0.12	UJ	0.0019	UJ	0.0024	U	0.0025	U	0.0022	UJ	0.11	U
108383/	m- and p-Xylenes	**5.4**	**J**	**0.0014**	**J**	**12**	**J**	**0.028**	**J**	0.032	UJ	**0.0032**	**J**	0.0008	U	0.00084	U	**0.12**	**J**	**0.0074**	**J**	0.00074	UB	0.00072	UB	**0.0033**	**J**	0.00089	UB	0.00065	U	**0.087**	**J**	0.00076	UJ	0.00097	UB	0.001	UB	**0.0027**	**J**	0.044	U
75092	Methylene chloride	0.18	UJ	0.0019	U	1.7	UJ	0.0023	UJ	0.07	UJ	**0.0019**	**J**	0.0017	U	0.0018	U	0.07	U	0.0015	UB	0.0016	U	0.0015	U	0.0017	U	0.0019	U	0.0014	U	**0.2**	**J**	0.0016	UJ	0.0021	U	0.0022	U	0.002	UJ	**0.28**	**J**
95476	o-Xylene	**1.1**	**J**	0.00073	U	**30**	**J**	**0.0075**	**J**	0.026	UJ	**0.0014**	**J**	0.00065	U	0.00068	U	**0.04**	**J**	**0.0077**	=	**0.0011**	**J**	**0.00072**	**J**	**0.0011**	**J**	**0.0013**	**J**	0.00053	U	0.038	UJ	0.00062	UJ	0.00079	U	0.00082	U	**0.001**	**J**	**0.039**	**J**
100425	Styrene	0.067	UJ	0.00074	U	0.63	UJ	0.00087	UJ	0.027	UJ	0.00064	UJ	0.00066	U	0.0007	U	0.027	U	**0.00086**	**J**	0.00061	U	0.00059	U	0.00064	U	0.00073	U	0.00054	U	0.039	UJ	0.00063	UJ	0.0008	U	0.00084	U	0.00075	UJ	0.036	U
127184	Tetrachloroethene	0.1	UJ	0.0011	U	0.94	UJ	0.0013	UJ	0.039	UJ	0.00094	UJ	0.00097	U	0.001	U	0.039	U	0.00084	U	**0.0013**	**J**	0.00087	U	0.00094	U	0.0011	U	**0.0022**	**J**	0.058	UJ	0.00093	UJ	0.0012	U	**0.15**	=	0.0011	UJ	**0.38**	=
108883	Toluene	**6**	**J**	0.0012	UB	**240**	**J**	**0.01**	**J**	**0.057**	**J**	0.001	UJ	0.0011	U	0.0011	UB	**0.35**	=	**0.006**	=	0.001	UB	0.00097	UB	0.001	UB	0.0012	UB	0.00088	U	**0.32**	**J**	0.001	U	0.0013	UB	0.0014	UB	**0.016**	**J**	**0.19**	**J**
156605	trans-1,2-Dichloroethene	0.11	UJ	0.0012	U	1	UJ	0.0014	UJ	0.043	UJ	0.001	UJ	0.0011	U	0.0011	U	0.043	U	0.00093	U	**0.0084**	=	0.00096	U	0.001	U	0.0012	U	0.00087	U	0.064	UJ	0.001	UJ	0.0013	U	**0.0014**	**J**	0.0012	UJ	0.059	U
1006102	trans-1,3-Dichloropropene	0.11	UJ	0.0012	U	1	UJ	0.0014	UJ	0.042	UJ	0.001	UJ	0.001	U	0.0011	U	0.043	U	0.00091	U	0.00097	U	0.00094	U	0.001	U	0.0012	U	0.00085	U	0.062	UJ	0.001	UJ	0.0013	U	0.0013	U	0.0012	UJ	0.058	U
79016	Trichloroethene	0.1	UJ	0.0011	U	0.94	UJ	0.0013	UJ	0.039	UJ	0.00094	UJ	0.00097	U	0.001	U	0.039	U	0.00084	U	**0.0031**	**J**	0.00087	U	0.00094	U	0.0011	U	**0.0085**	=	0.058	UJ	0.00093	UJ	0.0012	UJ	**0.044**	**J**	0.0011	UJ	0.054	U
75014	Vinyl chloride	0.18	UJ	0.0019	U	1.7	UJ	0.0023	UJ	0.07	UJ	0.0017	UJ	0.0017	U	0.0018	U	0.07	U	**0.0044**	**J**	**0.024**	=	**0.0017**	**J**	**0.028**	=	0.0019	U	**0.095**	=	0.1	UJ	0.0016	UJ	**0.12**	=	**0.04**	=	0.002	UJ	0.095	U
1330207	Xylenes	**6.5**	**J**	**0.002**	**J**	**42**	**J**	**0.036**	**J**	0.057	UJ	**0.0045**	**J**	0.0014	U	0.0015	U	**0.16**	**J**	**0.015**	=	**0.0031**	**J**	**0.0024**	**J**	**0.0044**	**J**	**0.0045**	**J**	0.0011	U	**0.12**	**J**	0.0013	UJ	**0.0024**	**J**	0.0018	U	**0.0037**	**J**	0.078	U
SEMIVOLATILE ORGANICS (m																																												
90120	1-Methylnaphthalene	**47**	=	0.051	U	0.046	U	0.042	U	0.043	U	0.045	U	0.05	U	0.05	U	**3.1**	=	0.048	U	0.048	U	**0.055**	**J**	0.049	U	**0.26**	**J**	0.046	U	**0.025**	**J**	0.018	U	**0.019**	**J**	0.02	U	0.044	U	**0.026**	**J**
95578	2-Chlorophenol	0.25	U	0.059	U	0.054	U	0.049	U	0.05	U	0.053	U	0.058	U	0.058	U	0.047	U	0.056	U	0.056	U	0.055	U	0.057	U	0.055	U	0.054	U	0.022	U	0.021	U	0.022	U	0.023	U	0.051	U	0.01	U
91576	2-Methylnaphthalene	**120**	=	0.051	U	0.046	U	0.042	U	0.043	U	0.045	U	0.05	U	0.05	U	**3.2**	=	0.048	U	0.048	U	**0.095**	**J**	0.049	U	**0.28**	**J**	0.046	U	**0.039**	**J**	0.018	U	**0.027**	**J**	0.02	U	0.044	U	**0.044**	**J**
95487	2-Methylphenol (o-cresol)	0.24	U	0.058	U	0.052	U	0.048	U	0.048	U	0.051	U	0.057	U	0.057	U	0.046	U	0.055	U	0.055	U	0.053	U	0.056	U	0.054	U	0.053	U	0.022	U	0.021	U	0.021	U	0.023	U	0.05	U	0.01	U
6579496	3 & 4 Methylphenol	0.25	U	0.059	U	0.054	U	0.049	U	0.05	U	0.053	U	0.058	U	0.058	U	0.047	U	0.056	U	0.056	U	0.055	U	0.057	U	0.055	U	0.054	U	0.022	U	0.021	U	0.022	U	0.023	U	0.051	U	0.01	U
106445	4-Methylphenol (p-cresol)																																												
83329	Acenaphthene	**2.8**	=	0.051	U	0.046	U	0.042	U	0.043	U	0.045	U	0.05	U	0.05	U	**7.9**	=	**0.058**	**J**	0.048	U	0.047	U	0.049	U	**0.33**	**J**	0.046	U	**0.044**	**J**	0.018	U	**0.048**	**J**	0.02	U	0.044	U	0.0088	U
208968	Acenaphthylene[2]	**6.9**	=	0.055	U	0.05	U	0.046	U	0.046	U	0.049	U	0.054	U	0.054	U	**0.25**	**J**	0.052	U	0.052	U	0.051	U	0.053	U	**0.47**	=	0.05	U	**0.058**	**J**	0.02	U	**0.054**	**J**	0.021	U	0.048	U	0.0095	U
120127	Anthracene	**37**	=	0.069	U	0.062	U	0.058	U	0.058	U	**0.08**	**J**	0.068	U	0.068	U	**26**	=	**0.12**	**J**	**0.1**	**J**	**0.13**	**J**	0.067	U	**1.4**	=	0.063	U	**0.17**	**J**	0.025	U	**0.099**	**J**	0.027	U	0.06	U	0.012	U
56553	Benzo(a)anthracene	**24**	=	0.054	U	0.048	U	0.045	U	0.045	U	**0.22**	**J**	0.053	U	0.052	U	**110**	=	**0.081**	**J**	**0.085**	**J**	**0.73**	=	0.052	U	**3.9**	=	0.049	U	**0.86**	=	0.019	U	**0.52**	=	0.021	U	**0.15**	**J**	**0.093**	=
50328	Benzo(a)pyrene	**18**	=	0.051	U	**0.19**	**J**	0.042	U	0.043	U	**0.23**	**J**	0.05	U	0.05	U	**98**	=	0.048	U	**0.12**	**J**	**1**	=	0.049	U	**4**	=	0.046	U	**1**	=	0.018	U	**0.69**	=	0.02	U	**0.13**	**J**	**0.13**	=
205992	Benzo(b)fluoranthene	**25**	=	0.072	U	**0.3**	**J**	0.06	U	0.06	U	**0.33**	**J**	0.071	U	0.07	U	**130**	=	0.068	U	**0.11**	**J**	**1.6**	=	0.069	U	**6.9**	=	0.065	U	**1.5**	=	0.026	U	**1.1**	=	0.028	U	**0.23**	**J**	**0.22**	=
191242	Benzo(g,h,i)perylene[2]	**8.3**	=	0.055	U	**0.11**	**J**	0.046	U	0.046	U	**0.13**	**J**	0.054	U	0.054	U	**56**	=	0.052	U	0.052	U	**0.58**	=	0.053	U	**2.2**	=	0.05	U	**0.61**	=	0.02	U	**0.45**	=	0.021	U	**0.11**	**J**	**0.084**	=
207089	Benzo(k)fluoranthene	**9.7**	=	0.051	U	**0.13**	**J**	0.042	U	0.043	U	**0.11**	**J**	0.05	U	0.05	U	**45**	=	0.048	U	0.048	U	**0.5**	=	0.049	U	**2**	=	0.046	U	**0.47**	=	0.018	U	**0.35**	=	0.02	U	**0.12**	**J**	**0.065**	**J**
117817	Bis(2-ethylhexyl)phthalate	0.22	U	0.052	U	0.047	U	0.044	U	0.044	U	0.046	U	0.051	U	0.051	U	0.042	U	0.049	U	0.05	U	0.048	U	0.05	U	0.048	U	0.047	U	**0.048**	**J**	0.019	U	0.019	U	0.02	U	0.045	U	0.009	U
86748	Carbazole	**24**	=	0.052	U	0.047	U	0.044	U	0.044	U	0.046	U	0.051	U	0.051	U	0.042	U	**0.16**	**J**	**0.11**	**J**	0.048	U	0.05	U	**0.7**	=	0.047	U	**0.053**	**J**	0.019	U	**0.045**	**J**	0.02	U	0.045	U	0.009	U
218019	Chrysene	**20**	=	0.049	U	0.045	U	0.041	U	0.041	U	**0.22**	**J**	0.049	U	0.048	U	**100**	=	**0.064**	**J**	**0.12**	**J**	**0.83**	=	0.048	U	**3.9**	=	0.045	U	**0.83**	=	0.018	U	**0.5**	=	0.019	U	**0.14**	**J**	**0.14**	=
53703	Dibenzo(a,h)anthracene	**4.8**	=	0.049	U	0.045	U	0.041	U	0.041	U	0.044	U	0.049	U	0.048	U	**14**	=	0.047	U	0.047	U	**0.3**	**J**	0.048	U	**0.83**	=	0.045	U	**0.2**	=	0.018	U	**0.15**	**J**	0.019	U	0.043	U	**0.033**	**J**
132649	Dibenzofuran	**15**	=	0.07	U	0.064	U	0.059	U	0.059	U	0.063	U	0.069	U	0.069	U	**2.2**	**J**	**0.099**	**J**	0.067	U	0.065	U	0.068	U	**0.49**	=	0.064	U	**0.051**	**J**	0.025	U	**0.045**	**J**	0.027	U	0.061	U	0.012	U
84662	Diethylphthalate	0.23	U	0.055	U	0.05	U	0.046	U	0.046	U	0.049	U	0.054	U	0.054	U	0.044	U	0.052	U	0.052	U	0.051	U	0.053	U	0.051	U	0.05	U	0.021	U	0.02	U	0.02	U	0.021	U	0.048	U	0.0095	U
206440	Fluoranthene	**65**	=	0.066	U	**0.12**	**J**	0.055	U	0.056	U	**0.55**	=	0.065	U	0.065	U	**120**	=	**0.23**	**J**	**0.17**	**J**	**0.74**	=	0.064	U	**7.7**	=	0.06	U	**1.2**	=	0.024	U	**0.73**	=	0.026	U	**0.18**	**J**	**0.14**	=
86737	Fluorene	**86**	=	0.068	U	0.061	U	0.057	U	0.057	U	0.06	U	0.067	U	0.066	U	**10**	=	**0.14**	**J**	**0.069**	**J**	**0.083**	**J**	0.065	U	**0.85**	=	0.062	U	**0.12**	**J**	0.024	U	**0.053**	**J**	0.026	U	0.059	U	0.012	U
193395	Indeno(1,2,3-cd)pyrene	**8**	=	0.051	U	0.046	U	0.042	U	0.043	U	**0.12**	**J**	0.05	U	0.05	U	**40**	=	0.048	U	0.048	U	**0.44**	=	0.049	U	**1.6**	=	0.046	U	**0.37**	**J**	0.018	UJ	**0.27**	**J**	0.02	U	**0.16**	**J**	**0.064**	**J**
91203	Naphthalene	**1700**	=	**0.094**	**J**	0.046	U	0.042	U	0.043	U	0.045	U	0.05	U	0.05	U	**2.8**	=	**0.19**	**J**	**0.42**	**J**	**0.31**	**J**	0.049	U	**2.4**	=	0.046	U	**0.11**	**J**	0.018	U	**0.11**	**J**	0.02	U	0.044	U	**0.046**	**J**
85018	Phenanthrene[2]	**98**	=	0.063	U	0.057	U	0.053	U	0.053	U	**0.19**	**J**	0.063	U	0.062	U	**55**	=	**0.4**	**J**	**0.22**	**J**	**0.43**	=	0.061	U	**3.2**	=	0.058	U	**0.52**	=	0.023	U	**0.17**	**J**	0.025	U	0.055	U	**0.067**	**J**
108952	Phenol	**3.8**	=	**0.12**	**J**	0.046	U	0.042	U	0.043	U	0.045	U	**0.1**	**J**	**0.096**	**J**	**1**	=	0.048	U	0.048	U	**0.66**	=	**0.08**	**J**	**0.42**	**J**	0.046	U	**0.081**	**J**	**0.046**	**J**	**0.078**	**J**	**0.051**	**J**	0.044	U	0.0088	U
129000	Pyrene	**49**	=	0.065	U	**0.15**	**J**	0.054	U	0.054	U	**0.39**	**J**	0.064	U	0.063	U	**160**	=	**0.16**	**J**	**0.13**	**J**	**0.62**	=	0.063	U	**6.4**	=	0.059	U	**1.8**	**J**	0.023	UJ	**0.86**	**J**	0.025	U	**0.18**	**J**	**0.13**	=

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0047 (2-4 ft) 16-Jan-08	CM-SB0047 (6-8 ft) 16-Jan-08	CM-SB0048 (12-14 ft) 18-Jan-08	CM-SB0048 (2-4 ft) 18-Jan-08	CM-SB0048 (6-8 ft) 18-Jan-08	CM-SB0049 (2-4 ft) 16-Jan-08	CM-SB0049 (6-8 ft) 16-Jan-08	CM-SB0049 (9-11 ft) 16-Jan-08	CM-SB0050 (2-4 ft) 16-Jan-08	CM-SB0050 (6-8 ft) 16-Jan-08	CM-SB0050 (9-11 ft) 16-Jan-08	CM-SB0051 (2-4 ft) 16-Jan-08	CM-SB0051 (7-9 ft) 16-Jan-08	CM-SB0052 (2-4 ft) 16-Jan-08	CM-SB0052 (8-10 ft) 16-Jan-08	CM-SB0053 (2-4 ft) 17-Jan-08	CM-SB0053 (7-9) 17-Jan-08	CM-SB0054 (2-4 ft) 17-Jan-08	CM-SB0054 (6-8 ft) 17-Jan-08	CM-SB0055 (2-4 ft) 15-Jan-08	CM-SB0056 (2-4 ft) 16-Jan-08
INORGANICS (mg/kg)																						
7440360	Antimony, Total																					
7440382	Arsenic, Total																					
7440393	Barium, Total																					
7440417	Beryllium, Total																					
7440439	Cadmium, Total																					
7440473	Chromium, Total																					
7440508	Copper, Total																					
7439921	Lead, Total																					
7440020	Nickel, Total																					
7782492	Selenium, Total																					
7440280	Thallium, Total																					
7440666	Zinc, Total																					
57125	Cyanide, Total																					

U = qualifier code for nondetected result
J = qualifier code for estimated result
COPC = chemical of potential concern
SSL = groundwater protection soil screening level (Arcadis & CH2MHill, 2009)

BOLD font indicates a detected chemical concentration.

1 = USEPA, November 2015. Regional Screening Levels (RSLs).

2 = No published RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate concentration.

3 = chemical retained as a COPC because the maximum concentration exceeds the RSL

4 = chemical excluded as a COPC because the maximum concentration does not exceed the RSL

5 = chemical conservatively retained as a COPC because there is no published RSL

6 = chemical retained as a COPC because it is included in the group of potentially carcinogenic PAHs, and at least one in that group has exceeded its screening level.

7 = Source: USEPA, November 2015, RSL table.

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	CM-SB0056 (7-9 ft) 16-Jan-08	CM-SB0057 (10-12 ft) 15-Jan-08	CM-SB0057 (2-4 ft) 15-Jan-08	CM-SB0057 (6-8 ft) 15-Jan-08	CM-SB0058 (2-4 ft) 15-Jan-08	CM-SB0058 (6-8 ft) 15-Jan-08	CM-SB0059 (2-4 ft) 17-Jan-08	CM-SB0059 (8-10 ft) 17-Jan-08	CM-SB0060 (3-5 ft) 15-Jan-08	CM-SB0060 (7-9 ft) 15-Jan-08	CM-SB0061 (2-4 ft) 15-Jan-08	CM-SB0061 (7-9 ft) 15-Jan-08	CM-SB0062 (12-14 ft) 15-Jan-08	CM-SB0062 (2-4 ft) 15-Jan-08	CM-SB0062 (7-9 ft) 15-Jan-08	CM-SB0063 (2-4 ft) 17-Jan-08	CM-SB0063 (5-7 ft) 17-Jan-08	26-SB0001 (13-15) 09-Jun-99	26-SB0001 (5-7) 09-Jun-99	26-SB0001 (9-11) 09-Jun-99	26-SB0002 (2-4) 09-Jun-99	26-SB0002 (4-6) 09-Jun-99	26-SB0002 (6-8) 09-Jun-99
VOLATILE ORGANICS (mg/kg)																									
79005	1,1,2-Trichloroethane	0.07 U	0.0013 U	0.0013 U	0.0011 U	0.048 U	0.0012 U	0.0012 UJ	**0.81** =	0.15 U	0.0013 U	0.072 U	0.068 U	0.001 U	0.087 U	0.0011 U	0.079 U	0.069 U	0.13 U	0.12 U	0.13 U	0.13 U	0.14 U	0.12 U
120821	1,2,4-Trichlorobenzene	0.059 U	0.058 U	0.052 U	0.052 U	0.05 U	0.053 U	0.051 U	0.054 U	0.05 U	0.057 U	0.056 U	0.056 U	0.05 U	0.024 U	0.053 U	0.052 U	0.057 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U
107062	1,2-Dichloroethane	0.12 U	0.0022 U	0.0022 U	0.0018 U	0.08 U	0.002 U	0.002 UJ	0.1 U	0.25 U	0.0022 U	0.12 U	0.11 U	0.0017 U	0.14 U	0.0018 U	0.13 U	0.12 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
78875	1,2-Dichloropropane	0.07 U	0.0013 U	0.0013 U	0.0011 U	0.048 U	0.0012 U	0.0012 UJ	0.063 U	0.15 U	0.0013 U	0.072 U	0.068 U	0.001 U	0.087 U	0.0011 U	0.079 U	0.069 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
106467	1,4-Dichlorobenzene	0.049 U	0.048 U	0.044 U	0.044 U	0.042 U	0.044 U	0.043 U	0.045 U	0.042 U	0.047 U	0.047 U	0.047 U	0.042 U	0.02 U	0.044 U	0.044 U	0.048 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U
78933	2-Butanone (MEK)	0.64 U	0.012 U	0.012 U	0.0098 U	0.44 U	0.011 U	0.011 UJ	0.57 U	1.4 U	0.012 U	0.66 U	0.63 U	0.0093 U	0.79 U	0.0099 U	0.72 U	0.64 U	3.1 U	3.1 U	3.1 U	3.3 U	3.5 U	2.9 U
67641	Acetone	**0.47 J**	0.0055 U	**0.037 J**	**0.0099 J**	0.21 U	**0.0072 J**	**0.026 J**	**0.3 J**	0.64 U	**0.014 J**	0.3 U	0.29 U	**0.022 J**	0.37 U	**0.023 J**	0.33 U	0.3 U	3.1 U	3.1 U	3.1 U	3.3 U	3.5 U	2.9 U
71432	Benzene	**0.14 J**	0.0012 U	**0.0022 J**	**0.001 J**	**0.089 J**	0.0011 U	**0.0024 J**	**3.8** =	**32** =	**1.8** =	**0.62** =	**0.64** =	0.00093 U	**0.12 J**	**0.003 J**	**0.31 J**	0.064 U	**5.5** =	**15** =	**10** =	**2.9** =	**8.4** =	**2.4** =
75150	Carbon disulfide	0.045 U	0.00084 U	0.00084 U	0.00069 U	0.031 U	0.00076 U	**0.0039 J**	0.041 U	0.098 U	**0.0016 J**	0.047 U	0.044 U	0.00066 U	0.056 U	0.0007 U	0.051 U	0.045 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
56235	Carbon tetrachloride	0.081 U	0.0015 U	0.0015 U	0.0012 U	0.056 U	0.0014 U	0.0014 UJ	0.073 U	0.18 U	0.0016 U	0.084 U	0.08 U	0.0012 U	0.1 U	0.0013 U	0.092 U	0.081 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
108907	Chlorobenzene	0.064 U	0.0012 U	0.0012 U	0.00098 U	**1.4** =	0.0011 U	0.0011 UJ	0.057 U	0.14 U	**0.0091** =	0.066 U	**0.0061 J**	0.00093 U	**0.087 J**	0.00099 U	0.072 U	**0.3** =	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
75003	Chloroethane	0.087 U	0.0016 U	0.0016 U	0.0013 U	0.06 U	0.0015 U	0.0015 UJ	**0.12 J**	0.19 U	0.0017 U	0.09 U	0.085 U	0.0013 U	0.11 U	0.0013 U	0.098 U	0.087 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
67663	Chloroform	0.048 U	0.00088 U	0.00088 U	0.00073 U	0.033 U	0.0008 U	0.00082 UJ	0.043 U	0.1 U	0.00091 U	0.049 U	0.047 U	0.00069 U	0.059 U	0.00074 U	0.054 U	0.047 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
156592	cis-1,2-Dichloroethene	0.056 U	0.001 U	0.001 U	0.00085 U	0.039 U	0.00094 U	0.00095 UJ	0.05 U	0.12 U	**0.014** =	0.057 U	0.055 U	0.00081 U	0.069 U	0.00086 U	0.063 U	0.056 U		0.31 U	0.31 U			
1006101	cis-1,3-Dichloropropene	0.058 U	0.0011 U	0.0011 U	0.00089 U	0.04 U	0.00098 U	0.00099 UJ	**0.12 J**	0.13 U	0.0011 U	0.06 U	0.057 U	0.00084 U	0.072 U	0.0009 U	0.065 U	0.058 U	0.31 U			0.33 U	0.35 U	0.29 U
100414	Ethylbenzene	0.1 U	0.0019 U	0.0019 U	0.0016 U	0.072 U	0.0018 U	0.0018 UJ	0.094 U	**0.69** =	**0.038** =	**0.15 J**	0.1 U	0.0015 U	0.13 U	0.0016 U	0.12 U	0.1 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
108383/	m- and p-Xylenes	0.043 U	0.0008 U	0.0008 U	**0.00073 J**	**0.45** =	0.00072 U	0.00074 UJ	**0.04 J**	**4.9** =	**0.094** =	**1.3** =	**0.00075 J**	**0.0007 J**	**0.085 J**	0.00066 U	**0.21 J**	0.043 U						
75092	Methylene chloride	**0.33** =	0.0017 U	0.0017 U	0.0014 U	0.064 U	0.0016 U	0.0016 UJ	**0.85** =	0.2 U	0.0018 U	0.096 U	0.091 U	0.0014 U	0.12 U	0.0014 U	0.1 U	0.093 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
95476	o-Xylene	0.035 U	0.00065 U	0.00065 U	0.00053 U	**0.11 J**	0.00059 U	0.0006 UJ	0.031 U	**3.1** =	**0.1** =	**0.31** =	**0.0007 J**	0.00051 U	0.043 U	0.00054 U	**0.084 J**	0.035 U			0.31 U			
100425	Styrene	0.035 U	0.00066 U	0.00066 U	0.00054 U	0.025 U	0.0006 U	0.00061 UJ	0.032 U	0.077 U	0.00068 U	0.036 U	0.035 U	0.00052 U	0.044 U	0.00055 U	0.04 U	0.035 U	0.31 U	0.31 U		0.33 U	0.35 U	0.29 U
127184	Tetrachloroethene	0.052 U	0.00097 U	0.00097 U	0.0008 U	0.036 U	0.00088 U	0.00089 UJ	0.047 U	0.11 U	0.001 U	0.054 U	0.051 U	0.00076 U	0.065 U	0.00081 U	0.059 U	0.052 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
108883	Toluene	0.058 U	**0.0013 J**	**0.0028 J**	**0.0018 J**	**0.25** =	**0.002 J**	0.00099 UJ	0.052 U	**17** =	**0.031** =	**120** =	**0.0025 J**	**0.0029 J**	**1.4** =	0.0009 U	**0.65** =	0.058 U	0.13 U	0.12 U	0.13 U	0.13 U	0.14 U	0.12 U
156605	trans-1,2-Dichloroethene	0.057 U	0.0011 U	0.0011 U	0.00088 U	0.04 U	0.00097 U	0.00098 UJ	0.052 U	0.12 U	0.0011 U	0.059 U	0.056 U	0.00084 U	0.071 U	0.00089 U	0.065 U	0.057 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
1006102	trans-1,3-Dichloropropene	0.056 U	0.001 U	0.001 U	0.00086 U	0.039 U	0.00095 U	0.00096 UJ	0.051 U	0.12 U	0.0011 U	0.058 U	0.055 U	0.00082 U	0.07 U	0.00087 U	0.064 U	0.056 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
79016	Trichloroethene	0.052 U	0.00097 U	0.00097 U	0.0008 U	0.036 U	0.00088 U	0.00089 UJ	0.047 UJ	0.11 U	0.001 U	0.054 U	0.051 U	0.00076 U	0.065 U	0.00081 U	0.059 UJ	0.052 UJ	0.13 U	0.12 U	0.13 U	0.13 U	0.14 U	0.12 U
75014	Vinyl chloride	0.093 U	0.0017 U	0.0017 U	0.0014 U	0.064 U	0.0016 U	0.0016 UJ	0.084 U	0.2 U	**0.022** =	0.096 U	0.091 U	0.0014 U	0.12 U	0.0014 U	0.1 U	0.093 U	0.063 U	0.062 U	0.063 U	0.066 U	0.069 U	0.059 U
1330207	Xylenes	0.075 U	0.0014 U	0.0014 U	0.0012 U	**0.56** =	0.0013 U	0.0013 UJ	0.068 U	**7.9** =	**0.2** =	**1.6** =	**0.0015 J**	0.0011 U	**0.12 J**	0.0012 U	**0.29 J**	0.075 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U
SEMIVOLATILE ORGANICS (m																								
90120	1-Methylnaphthalene	0.051 U	0.05 U	0.045 U	0.045 U	0.043 U	0.046 U	0.044 U	0.046 U	**0.54** =	0.049 U	**0.63** =	0.048 U	0.043 U	0.021 U	0.045 U	**0.17 J**	0.049 U						
95578	2-Chlorophenol	0.059 U	0.058 U	0.052 U	0.052 U	0.05 U	0.053 U	0.051 U	0.054 U	0.05 U	0.057 U	0.056 U	0.056 U	0.05 U	0.024 U	0.053 U	0.052 U	0.057 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U
91576	2-Methylnaphthalene	0.051 U	0.05 U	0.045 U	0.045 U	0.043 U	0.046 U	0.044 U	0.046 U	**0.8** =	0.049 U	**0.77** =	0.048 U	0.043 U	0.021 U	0.045 U	**0.32 J**	0.049 U	0.41 U	0.41 U	**3.1** =	0.43 U	0.46 U	0.39 U
95487	2-Methylphenol (o-cresol)	0.058 U	0.057 U	0.051 U	0.051 U	0.049 U	0.052 U	0.05 U	0.052 U	0.049 U	0.055 U	0.055 U	0.055 U	0.049 U	0.024 U	0.052 U	0.051 U	0.056 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U
6579496	3 & 4 Methylphenol	0.059 U	0.058 U	0.052 U	0.052 U	0.05 U	0.053 U	0.051 U	0.054 U	0.05 U	0.057 U	0.056 U	0.056 U	0.05 U	0.024 U	0.053 U	0.052 U	0.057 U						
106445	4-Methylphenol (p-cresol)																		0.41 U	0.41 U	**0.4** =	0.43 U	0.46 U	0.39 U
83329	Acenaphthene	0.051 U	0.05 U	0.045 U	0.045 U	**0.14 J**	0.046 U	0.044 U	0.046 U	**0.2 J**	0.049 U	**0.42 J**	0.048 U	0.043 U	0.021 U	0.045 U	**0.17 J**	0.049 U	0.41 U	0.41 U	**0.68** =	0.43 U	0.46 U	0.39 U
208968	Acenaphthylene[2]	0.055 U	0.054 U	0.048 U	0.049 U	0.047 U	0.049 U	**0.21 J**	0.05 U	**0.19 J**	0.053 U	**0.8** =	0.052 U	0.047 U	0.023 U	0.049 U	**0.48** =	0.053 U	0.41 U	0.41 U	**1.9** =	0.43 U	0.46 U	0.39 U
120127	Anthracene	0.069 U	0.068 U	0.061 U	0.061 U	**0.21 J**	0.062 U	**0.32 J**	0.062 U	**0.59** =	0.066 U	**2.9** =	0.066 U	0.059 U	0.028 U	0.062 U	**0.92** =	0.067 U	0.41 U	0.41 U	**2.4** =	0.43 U	0.46 U	0.39 U
56553	Benzo(a)anthracene	0.054 U	0.052 U	0.047 U	0.047 U	0.046 U	0.048 U	**1** =	0.048 U	**1.2** =	0.051 U	**9** =	0.051 U	0.046 U	0.022 U	0.048 U	**4.4** =	0.052 U	0.41 U	0.41 U	**5.4** =	0.43 U	0.46 U	0.39 U
50328	Benzo(a)pyrene	0.051 U	0.05 U	0.045 U	0.045 U	**2.5** =	0.046 U	**1.4** =	0.046 U	**1.4** =	0.049 U	**8.3** =	0.048 U	0.043 U	0.021 U	0.045 U	**4.3** =	0.049 U	0.41 U	0.41 U	**3.6** =	0.43 U	0.46 U	0.39 U
205992	Benzo(b)fluoranthene	0.072 U	0.07 U	0.063 U	0.064 U	**3.4** =	0.065 U	**1.7** =	0.065 U	**2.3** =	0.069 U	**14** =	0.068 U	0.061 U	0.029 U	0.064 U	**7** =	0.07 U	0.41 U	0.41 U	**4.9** =	0.43 U	0.46 U	0.39 U
191242	Benzo(g,h,i)perylene[2]	0.055 U	0.054 U	0.048 U	0.049 U	**1.4** =	0.049 U	**0.99** =	0.05 U	**0.23 J**	0.053 U	**5.4** =	0.052 U	0.047 U	0.023 U	0.049 U	**2.3** =	0.053 U	0.41 U	0.41 U	**1.9** =	0.43 U	0.46 U	0.39 U
207089	Benzo(k)fluoranthene	0.051 U	0.05 U	0.045 U	0.045 U	**1.1** =	0.046 U	**0.88** =	0.046 U	**0.88** =	0.049 U	**4.1** =	0.048 U	0.043 U	0.021 U	0.045 U	**2.5** =	0.049 U	0.41 U	0.41 U	**2.1** =	0.43 U	0.46 U	0.39 U
117817	Bis(2-ethylhexyl)phthalate	0.052 U	0.051 U	0.046 U	0.046 U	0.044 U	0.047 U	0.045 U	0.047 U	0.044 U	0.05 U	0.05 U	0.05 U	0.044 U	0.021 U	0.047 U	0.046 U	0.051 U	**0.43** =	0.41 U	0.41 U	0.43 U	**0.69** =	0.39 U
86748	Carbazole	0.052 U	0.051 U	0.046 U	0.046 U	0.044 U	0.047 U	**0.095 J**	0.047 U	**0.75** =	0.05 U	**1.4** =	0.05 U	0.044 U	0.021 U	0.047 U	**0.23 J**	0.051 U						
218019	Chrysene	0.049 U	0.048 U	0.044 U	0.044 U	0.042 U	0.044 U	**1.2** =	0.045 U	**1.4** =	0.047 U	**8.9** =	0.047 U	0.042 U	0.02 U	0.044 U	**4.7** =	0.048 U	0.41 U	0.41 U	**4** =	0.43 U	0.46 U	0.39 U
53703	Dibenzo(a,h)anthracene	0.049 U	0.048 U	0.044 U	0.044 U	**0.46** =	0.044 U	**0.36 J**	0.045 U	**0.27 J**	0.047 U	**1.8** =	0.047 U	0.042 U	0.02 U	0.044 U	**0.85** =	0.048 U	0.41 U	0.41 U	**0.51** =	0.43 U	0.46 U	0.39 U
132649	Dibenzofuran	0.071 U	0.069 U	0.062 U	0.062 U	0.06 U	0.063 U	0.061 U	0.064 U	**0.47** =	0.068 U	**1.1** =	0.067 U	0.06 U	0.029 U	0.063 U	**0.24 J**	0.068 U	0.41 U	0.41 U	**2.1** =	0.43 U	0.46 U	0.39 U
84662	Diethylphthalate	0.055 U	0.054 U	0.048 U	0.049 U	0.047 U	0.049 U	0.048 U	0.05 U	0.047 U	0.053 U	0.052 U	0.052 U	0.047 U	0.023 U	0.049 U	0.049 U	0.053 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U
206440	Fluoranthene	0.066 U	0.065 U	0.058 U	0.059 U	**2.4** =	0.06 U	**1.5** =	0.06 U	**2.6** =	0.064 U	**23** =	0.063 U	0.056 U	0.027 U	0.059 U	**9.1** =	0.064 U	**1** =	0.41 U	**14** =	0.43 U	0.46 U	0.39 U
86737	Fluorene	0.068 U	0.066 U	0.06 U	0.06 U	**0.15 J**	0.061 U	**0.13 J**	0.061 U	**1** =	0.065 U	**3** =	0.064 U	0.058 U	0.028 U	0.061 U	**0.32 J**	0.066 U	0.41 U	0.41 U	**4** =	0.43 U	0.46 U	0.39 U
193395	Indeno(1,2,3-cd)pyrene	0.051 U	0.05 U	0.045 U	0.045 U	**0.95** =	0.046 U	**0.71 J**	0.046 UJ	**0.68** =	0.049 U	**4.2** =	0.048 U	0.043 U	0.021 U	0.045 U	**1.6 J**	0.049 UJ	0.41 U	0.41 U	**1.9** =	0.43 U	0.46 U	0.39 U
91203	Naphthalene	0.051 U	0.05 U	0.045 U	0.045 U	**0.33 J**	0.046 U	0.044 U	**0.49** =	**5.7** =	0.049 U	**3.7** =	**0.33 J**	0.043 U	**0.059 J**	0.045 U	**0.72** =	0.049 U	**1.5** =	0.41 U	**38** =	0.43 U	0.46 U	0.39 U
85018	Phenanthrene[2]	0.064 U	0.062 U	0.056 U	0.056 U	**0.4** =	0.057 U	**0.82** =	0.057 U	**2.7** =	0.061 U	**17** =	0.06 U	0.054 U	0.026 U	0.057 U	**3.1** =	0.061 U	**1.1** =	0.41 U	**14** =	0.43 U	0.46 U	0.39 U
108952	Phenol	0.051 U	0.05 U	0.045 U	0.045 U	0.043 U	0.046 U	0.044 U	**0.34 J**	**7.9** =	0.049 U	**1.2** =	0.048 U	0.043 U	**0.038 J**	0.045 U	**0.52** =	0.049 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U
129000	Pyrene	0.065 U	0.063 U	0.057 U	0.057 U	**2.2** =	0.058 U	**2 J**	0.059 UJ	**2.6** =	0.062 U	**17** =	0.062 U	0.055 U	0.027 U	0.058 U	**9.6 J**	0.063 UJ	**0.56** =	0.41 U	**8.8** =	0.43 U	0.46 U	0.39 U

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

| CAS No. | Chemical Name | CM-SB0056 (7-9 ft) 16-Jan-08 | | CM-SB0057 (10-12 ft) 15-Jan-08 | | CM-SB0057 (2-4 ft) 15-Jan-08 | | CM-SB0057 (6-8 ft) 15-Jan-08 | | CM-SB0058 (2-4 ft) 15-Jan-08 | | CM-SB0058 (6-8 ft) 15-Jan-08 | | CM-SB0059 (2-4 ft) 17-Jan-08 | | CM-SB0059 (8-10 ft) 17-Jan-08 | | CM-SB0060 (3-5 ft) 15-Jan-08 | | CM-SB0060 (7-9 ft) 15-Jan-08 | | CM-SB0061 (2-4 ft) 15-Jan-08 | | CM-SB0061 (7-9 ft) 15-Jan-08 | | CM-SB0062 (12-14 ft) 15-Jan-08 | | CM-SB0062 (2-4 ft) 15-Jan-08 | | CM-SB0062 (7-9 ft) 15-Jan-08 | | CM-SB0063 (2-4 ft) 17-Jan-08 | | CM-SB0063 (5-7 ft) 17-Jan-08 | | 26-SB0001 (13-15) 09-Jun-99 | | 26-SB0001 (5-7) 09-Jun-99 | | 26-SB0001 (9-11) 09-Jun-99 | | 26-SB0002 (2-4) 09-Jun-99 | | 26-SB0002 (4-6) 09-Jun-99 | | 26-SB0002 (6-8) 09-Jun-99 | |
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Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	27-SB0001 (10-12) 10-Jun-99		27-SB0001 (2-4) 10-Jun-99		27-SB0001 (6-8) 10-Jun-99		27-SB0002 (3-5) 11-Jun-99		27-SB0002 (5-7) 11-Jun-99		27-SB0002 (9-11) 11-Jun-99		29-SB0001 (12-13) 09-Jun-99		29-SB0001 (4-6) 09-Jun-99		29-SB0001 (8-10) 09-Jun-99		29-SB0002 (4-4.5) 09-Jun-99		31-SB0001 (0.5-2) 10-Jun-99		31-SB0001 (2-4) 10-Jun-99		31-SB0001 (6-8) 10-Jun-99		31-SB0002 (2-4) 10-Jun-99		31-SB0002 (4-6) 10-Jun-99		31-SB0002 (8-10) 10-Jun-99		MW-52 (0-2) 11-Jul-00		MW-52 (4-6) 11-Jul-00		MW-52 (8-10) 11-Jul-00		MW-53 (2-4) 12-Jul-00		MW-53 (4-6) 12-Jul-00		MW-53 (8-10) 12-Jul-00	
VOLATILE ORGANICS (mg/kg)																																															
79005	1,1,2-Trichloroethane	0.13	U	0.13	U	0.13	U	0.13	U	0.13	U	0.14	U	0.14	U	0.14	U	0.13	U	0.14	U	0.13	U	0.12	U	0.12	U	0.12	U	0.14	U	0.13	U	0.11	U	0.14	U	0.13	U	0.12	U	0.13	U	0.14	U
120821	1,2,4-Trichlorobenzene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	**0.93**	=	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
107062	1,2-Dichloroethane	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	0.35	U	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
78875	1,2-Dichloropropane	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	0.35	U	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
106467	1,4-Dichlorobenzene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
78933	2-Butanone (MEK)	3.3	U	3.2	U	3.2	U	3.3	U	3.2	U	3.4	U	3.5	U	3.4	U	3.3	U	3.5	U	3.2	U	3.1	U	3	U	3	U	3.4	U	3.3	U	2.8	U	3.5	U	3.3	U	3.1	U	3.3	U	3.6	U
67641	Acetone	3.3	U	3.2	U	3.2	U	3.3	U	3.2	U	3.4	U	3.5	U	**3.4**	=	3.3	U	3.5	U	3.2	U	3.1	U	3	U	3	U	3.4	U	3.3	U	2.8	U	3.5	U	3.3	U	3.1	U	3.3	U	3.6	U
71432	Benzene	**1.6**	=	**3.4**	=	**0.89**	=	**8.6**	=	**14**	=	**1.2**	=	**6.5**	=	**5**	=	**3.9**	=	**59**	=	**2.3**	=	**0.76**	=	**0.81**	=	**3.3**	=	**0.53**	=	0.33	U	0.28	U	0.35	U	0.33	U	**1.2**	=	**2.6**	=	**3.9**	=
75150	Carbon disulfide	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	0.35	U	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
56235	Carbon tetrachloride	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	0.35	U	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
108907	Chlorobenzene	**29**	=	**420**	=	**72**	=	**350**	=	**6100**	=	**330**	=	**22**	=	**19**	=	**15**	=	**21**	=	**2.1**	=	**1**	=	0.3	U	**3**	=	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
75003	Chloroethane	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	0.35	U	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
67663	Chloroform	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	0.35	U	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
156592	cis-1,2-Dichloroethene																																														
1006101	cis-1,3-Dichloropropene	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	0.35	U	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
100414	Ethylbenzene	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	**0.93**	=	**32**	=	**11**	=	**0.77**	=	**0.39**	=	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
108383/	m- and p-Xylenes																																													
75092	Methylene chloride	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	0.35	U	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
95476	o-Xylene																																													
100425	Styrene	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	0.35	U	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
127184	Tetrachloroethene	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	**1.2**	=	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
108883	Toluene	**17**	=	**1000**	=	**42**	=	**130**	=	**160**	=	**14**	=	**210**	=	**210**	=	**120**	=	**36**	=	**10**	=	**8.7**	=	**2.3**	=	**3.4**	=	**0.34**	=	0.13	U	0.11	U	0.14	U	0.13	U	0.12	U	**6.9**	=	**10**	=
156605	trans-1,2-Dichloroethene	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	0.35	U	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
1006102	trans-1,3-Dichloropropene	0.33	U	0.32	U	0.32	U	0.33	U	0.32	U	0.34	U	0.35	U	0.34	U	0.33	U	0.35	U	0.32	U	0.31	U	0.3	U	0.3	U	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	0.31	U	0.33	U	0.36	U
79016	Trichloroethene	0.13	U	0.13	U	0.13	U	0.13	U	0.13	U	0.14	U	0.14	U	0.14	U	0.13	U	0.14	U	0.13	U	0.12	U	0.12	U	0.12	U	0.14	U	0.13	U	0.11	U	0.14	U	0.13	U	0.12	U	0.13	U	0.14	U
75014	Vinyl chloride	0.066	U	0.063	U	0.065	U	0.066	U	0.064	U	0.068	U	0.07	U	0.068	U	0.067	U	**0.087**	=	0.063	U	0.062	U	0.061	U	0.06	U	0.068	U	0.067	U	0.057	U	0.07	U	0.066	U	0.062	U	0.066	U	0.071	U
1330207	Xylenes	0.33	U	**4.9**	=	0.32	U	**0.54**	=	**1.3**	=	0.34	U	**5.8**	=	**8.1**	=	**4.6**	=	**12**	=	**160**	=	**31**	=	**5.1**	=	**2**	=	0.34	U	0.33	U	0.28	U	0.35	U	0.33	U	**2.9**	=	**1.4**	=	**3**	=
SEMIVOLATILE ORGANICS (m																																													
90120	1-Methylnaphthalene																																													
95578	2-Chlorophenol	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
91576	2-Methylnaphthalene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
95487	2-Methylphenol (o-cresol)	0.43	U	**0.67**	=	0.43	U	0.43	U	0.42	U	0.45	U	**0.49**	=	0.45	U	**0.47**	=	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
6579496	3 & 4 Methylphenol																																													
106445	4-Methylphenol (p-cresol)	0.43	U	**0.86**	=	0.43	U	0.43	U	0.42	U	0.45	U	**1.3**	=	**1.3**	=	**1.5**	=	**0.52**	=	0.42	U	0.41	U	**0.7**	=	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
83329	Acenaphthene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
208968	Acenaphthylene[2]	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
120127	Anthracene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
56553	Benzo(a)anthracene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
50328	Benzo(a)pyrene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
205992	Benzo(b)fluoranthene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
191242	Benzo(g,h,i)perylene[2]	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
207089	Benzo(k)fluoranthene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
117817	Bis(2-ethylhexyl)phthalate	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	**0.75**	=	0.45	U	**0.6**	=	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
86748	Carbazole																																													
218019	Chrysene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
53703	Dibenzo(a,h)anthracene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
132649	Dibenzofuran	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
84662	Diethylphthalate	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
206440	Fluoranthene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
86737	Fluorene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
193395	Indeno(1,2,3-cd)pyrene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
91203	Naphthalene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
85018	Phenanthrene[2]	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U
108952	Phenol	**0.67**	=	**85**	=	**91**	=	**67**	=	**180**	=	**180**	=	**35**	=	**11**	=	**7.1**	=	**2**	=	**20**	=	**1.2**	=	**1.2**	=	**0.76**	=	**0.79**	=	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	**0.62**	=
129000	Pyrene	0.43	U	0.42	U	0.43	U	0.43	U	0.42	U	0.45	U	0.46	U	0.45	U	0.44	U	0.46	U	0.42	U	0.41	U	0.4	U	0.4	U	0.45	U	0.44	U	0.38	U	0.46	U	0.43	U	0.41	U	0.43	U	0.47	U

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	27-SB0001 (10-12) 10-Jun-99		27-SB0001 (2-4) 10-Jun-99		27-SB0001 (6-8) 10-Jun-99		27-SB0002 (3-5) 11-Jun-99		27-SB0002 (5-7) 11-Jun-99		27-SB0002 (9-11) 11-Jun-99		29-SB0001 (12-13) 09-Jun-99		29-SB0001 (4-6) 09-Jun-99		29-SB0001 (8-10) 09-Jun-99		29-SB0002 (4-4.5) 09-Jun-99		31-SB0001 (0.5-2) 10-Jun-99		31-SB0001 (2-4) 10-Jun-99		31-SB0001 (6-8) 10-Jun-99		31-SB0002 (2-4) 10-Jun-99		31-SB0002 (4-6) 10-Jun-99		31-SB0002 (8-10) 10-Jun-99		MW-52 (0-2) 11-Jul-00		MW-52 (4-6) 11-Jul-00		MW-52 (8-10) 11-Jul-00		MW-53 (2-4) 12-Jul-00		MW-53 (4-6) 12-Jul-00		MW-53 (8-10) 12-Jul-00	
INORGANICS (mg/kg)																																											
7440360	Antimony, Total	0.61	U	0.59	U	0.63	U	0.65	U	0.64	U	0.66	U	0.68	U	0.64	U	0.64	U	0.69	U	**0.61**	=	**1.2**	=	**0.76**	=	**0.98**	=	0.67	U	0.66	U													
7440382	Arsenic, Total	**4.8**	=	**5.1**	=	**15**	=	**18**	=	**11**	=	**10**	=	**2.9**	=	**5.6**	=	**6.2**	=	**4**	=	**8.4**	=	**5.3**	=	**5.2**	=	**4.3**	=	**4.3**	=	**1.5**	=	**7.9**	=	**15**	=	**16**	=	**18**	=	**9.2**	=	**16**	=
7440393	Barium, Total	**13**	=	**27**	=	**12**	=	**21**	=	**20**	=	**21**	=	**19**	=	**19**	=	**4.2**	=	**26**	=	**39**	=	**49**	=	**48**	=	**98**	=	**42**	=	**31**	=	**49**	=	**34**	=	**37**	=	**42**	=	**26**	=	**64**	=
7440417	Beryllium, Total	**0.2**	=	0.06	U	**0.55**	=	0.07	U	0.06	U	0.07	U	**0.2**	=	0.06	U	**0.95**	=	0.07	U	0.06	U	0.06	U	0.06	U	0.06	U	**0.48**	=	**0.21**	=	**1.1**	=	0.7	U	**1.3**	=	**0.7**	=	**1.5**	=	**1.5**	=
7440439	Cadmium, Total	**0.34**	=	**0.83**	=	**0.25**	=	**2**	=	**1.8**	=	**1.6**	=	**0.4**	=	**1.4**	=	0.06	U	**0.65**	=	**1.5**	=	**3.4**	=	**1.8**	=	**3.6**	=	**1.1**	=	**0.26**	=	**1**	J	**2**	J	**2**	J	**4.8**	J	**11**	J	**2.4**	J
7440473	Chromium, Total	**2.8**	=	**36**	=	**2**	=	**22**	=	**17**	=	**13**	=	**2.2**	=	**9.8**	=	**0.64**	=	**6.4**	=	**22**	=	**23**	=	**13**	=	**19**	=	**9.5**	=	**3.5**	=	**10**	J	**34**	J	**23**	J	**60**	J	**120**	J	**35**	J
7440508	Copper, Total	**1.8**	=	0.24	U	**0.94**	=	**1.3**	=	0.25	U	0.26	U	**4.2**	=	**2.3**	=	**0.86**	=	**1.1**	=	**13**	=	0.24	U	0.24	U	0.22	U	0.27	U	**0.48**	=	**12**	J	**13**	J	**15**	J	**5.9**	J	**6.6**	J	**15**	J
7439921	Lead, Total	**2.5**	=	**24**	=	**30**	=	**46**	=	**6.1**	=	**5.2**	=	**2.4**	=	**5.9**	=	**0.85**	=	**3.3**	=	**16**	=	**18**	=	**15**	=	**86**	=	**6**	=	**2.7**	=	**11**	J	**20**	J	**24**	J	**29**	J	**57**	J	**27**	J
7440020	Nickel, Total	**3.6**	=	**12**	=	**3.1**	=	**2.7**	=	**3.1**	=	**2.6**	=	**5.6**	=	**5.7**	=	**2.4**	=	**4.1**	=	**5.1**	=	**2.8**	=	**2.7**	=	**2.8**	=	**5.7**	=	**6.1**	=	**8.1**	=	**15**	=	**17**	=	**7.8**	=	**16**	=	**19**	=
7782492	Selenium, Total	0.12	U	0.12	U	0.13	U	**1.2**	=	**1**	=	**0.89**	=	0.13	U	0.12	U	0.11	U	0.13	U	0.13	U	0.12	U	0.12	U	0.12	U	0.13	U	0.13	U	4.5	UJ	5.6	UJ	5.2	UJ	4.9	UJ	5.3	UJ	5.7	UJ
7440280	Thallium, Total	**0.07**	=	**0.11**	=	**0.08**	=	**0.09**	=	**0.07**	=	**0.07**	=	**0.05**	=	**0.1**	=	**0.08**	=	**0.09**	=	**0.09**	=	**0.09**	=	**0.06**	=	**0.07**	=	**0.09**	=	**0.04**	=	4.5	U	5.6	U	5.2	U	4.9	U	5.2	U	5.7	U
7440666	Zinc, Total	**4.6**	=	**11**	=	**2.2**	=	**8.2**	=	**8.1**	=	**6.2**	=	**7.6**	=	**11**	=	**1.7**	=	**6.8**	=	**23**	=	**7.8**	=	**5.6**	=	**7.2**	=	**5.5**	=	**4.6**	=	**40**	J	**33**	J	**46**	J	**36**	J	**57**	J	**41**	J
57125	Cyanide, Total	0.26	U	0.25	U	0.26	U	**0.28**	=	0.26	U	**0.32**	=	0.28	U	0.27	U	**0.31**	=	0.28	U	0.25	U	0.25	U	0.24	U	0.24	U	0.24	U	0.27	U	0.2	U	0.2	U	0.2	U	**0.2**	=	0.2	U	0.2	U

ode for nondetected result
de for estimated result
licates a detected chemical concentration.
ovember 2015. Regional Screening Levels (RSLs).
ed RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate concentration.
tained as a COPC because the maximum concentration exceeds the RSL
xcluded as a COPC because the maximum concentration does not exceed the RSL
onservatively retained as a COPC because there is no published RSL
tained as a COPC because it is included in the group of potentially carcinogenic PAHs,
one in that group has exceeded its screening level.
EPA, November 2015, RSL table.

COPC = chemical of potential concern
SSL = groundwater protection soil screening level (Arcadis & CH2MHill, 2009)

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	MW-54 (2-4) 12-Jul-00		MW-54 (8-10) 12-Jul-00		MW-55 (2.5-4) 11-Jul-00		MW-55 (4-6) 11-Jul-00		MW-55 (6-8) 11-Jul-00		Number of Samples	Number of Detections	Concentration Min		Concentration Max		RSL Value[1]	COPC?	SSLs Value	SSLs Exceeded?
VOLATILE ORGANICS (mg/kg)																					
79005	1,1,2-Trichloroethane	0.12	U	0.12	U	0.13	U	0.14	U	0.13	U	177	1	0.00086	U	0.81		0.63	**Yes** [3]	0.054	**Yes**
120821	1,2,4-Trichlorobenzene	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	2	0.019	U	0.93		26	No [4]	5.3	No
107062	1,2-Dichloroethane	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	177	2	0.0014	U	1.1		2	No [4]	0.04	**Yes**
78875	1,2-Dichloropropane	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	177	1	0.00086	U	1.3		4.4	No [4]	0.06	**Yes**
106467	1,4-Dichlorobenzene	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	4	0.0085	U	0.31		11	No [4]	3.58	No
78933	2-Butanone (MEK)	3	U	2.9	U	3.2	U	3.4	U	3.3	U	177	4	0.0079	U	6.3		19000	No [4]	31	No
67641	Acetone	3	U	2.9	U	3.2	U	3.4	U	3.3	U	177	59	0.0037	U	55		67000	No [4]	92	No
71432	Benzene	**0.95**	=	0.29	U	**1.5**	=	**0.64**	=	0.33	U	176	146	0.00093	U	1400		5.1	**Yes** [3]	0.11	**Yes**
75150	Carbon disulfide	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	177	34	0.00056	U	0.57		350	No [4]	5.2	No
56235	Carbon tetrachloride	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	177	2	0.001	U	0.35		2.9	No [4]	0.05	**Yes**
108907	Chlorobenzene	0.3	U	0.29	U	**7.9**	=	**5.2**	=	**1.2**	=	177	96	0.00079	U	6100		130	**Yes** [3]	3.1	**Yes**
75003	Chloroethane	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	177	1	0.0011	U	0.12		5700	No [4]	0.59 [7]	No
67663	Chloroform	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	177	1	0.00059	U	0.0017		1.4	No [4]	0.0015	**Yes**
156592	cis-1,2-Dichloroethene											146	15	0.00069	U	4.9		230	No [4]	0.61	**Yes**
1006101	cis-1,3-Dichloropropene	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	175	2	0.00072	U	0.12		8.2	No [4]	0.01	**Yes**
100414	Ethylbenzene	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	177	38	0.0013	U	460		25	**Yes** [3]	40	**Yes**
108383/	m- and p-Xylenes											144	76	0.00053	U	2100		240	No [4]	490	**Yes**
75092	Methylene chloride	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	177	28	0.0011	U	130		320	No [4]	0.033	**Yes**
95476	o-Xylene											145	72	0.00043	U	1400		280	No [4]	490	**Yes**
100425	Styrene	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	176	3	0.00044	U	0.9		3500	No [4]	5.6	No
127184	Tetrachloroethene	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	177	9	0.00065	U	2		39	No [4]	0.08	**Yes**
108883	Toluene	1.3	UJ	0.12	U	**0.49**	=	**1.5**	=	**0.9**	=	177	117	0.00072	U	56000		4700	**Yes** [3]	31	**Yes**
156605	trans-1,2-Dichloroethene	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	177	5	0.00071	U	0.61		2300	No [4]	0.91	No
1006102	trans-1,3-Dichloropropene	0.3	U	0.29	U	0.32	U	0.34	U	0.33	U	177	1	0.0007	U	0.0064		8.2	No [4]	0.01	No
79016	Trichloroethene	0.12	U	0.12	U	0.13	U	0.14	U	0.13	U	177	8	0.00065	U	0.44		1.9	No [4]	0.058	**Yes**
75014	Vinyl chloride	0.06	U	0.059	U	0.064	U	0.068	U	0.066	U	177	16	0.0011	U	3.3		1.7	**Yes** [3]	0.017	**Yes**
1330207	Xylenes	**2.5**	**J**	0.29	U	0.32	U	0.34	U	0.33	U	174	96	0.00093	U	2500		250	**Yes** [3]	490	**Yes**
SEMIVOLATILE ORGANICS (m																					
90120	1-Methylnaphthalene											134	38	0.017	U	47		73	No [4]	0.006 [7]	**Yes**
95578	2-Chlorophenol	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	4	0.01	U	3.4		580	No [4]	0.0074 [7]	**Yes**
91576	2-Methylnaphthalene	**0.41**	=	0.39	U	0.42	U	0.45	U	0.43	U	167	43	0.017	U	120		300	No [4]	45	**Yes**
95487	2-Methylphenol (o-cresol)	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	25	0.01	U	5		4100	No [4]	87	No
6579496	3 & 4 Methylphenol											134	26	0.01	U	4		4100	No [4]	0.17 [7]	**Yes**
106445	4-Methylphenol (p-cresol)	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	33	7	0.38	U	1.5		8200	No [4]	0.15 [7]	**Yes**
83329	Acenaphthene	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	30	0.0088	U	94		4500	No [4]	1400	No
208968	Acenaphthylene[2]	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	30	0.0095	U	6.9		2300	No [4]	23000	No
120127	Anthracene	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	48	0.012	U	140		23000	No [4]	5.8 [7]	**Yes**
56553	Benzo(a)anthracene	**0.55**	=	**0.54**	=	0.42	U	0.45	U	0.43	U	167	56	0.018	U	110		2.9	**Yes** [3]	1	**Yes**
50328	Benzo(a)pyrene	**0.42**	=	**0.42**	=	0.42	U	0.45	U	0.43	U	167	51	0.017	U	98		0.29	**Yes** [3]	16	**Yes**
205992	Benzo(b)fluoranthene	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	53	0.024	U	130		2.9	**Yes** [3]	2	**Yes**
191242	Benzo(g,h,i)perylene[2]	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	55	0.019	U	56		2300	No [4]	nd [7]	No
207089	Benzo(k)fluoranthene	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	50	0.017	U	45		29	**Yes** [3]	23	**Yes**
117817	Bis(2-ethylhexyl)phthalate	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	9	0.009	U	0.75		160	No [4]	100	No
86748	Carbazole											134	37	0.009	U	44		nd	**Yes** [5]	0.1	**Yes**
218019	Chrysene	**0.47**	=	**0.5**	=	0.42	U	0.45	U	0.43	U	167	57	0.016	U	100		290	**Yes** [6]	69	**Yes**
53703	Dibenzo(a,h)anthracene	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	41	0.016	U	14		0.29	**Yes** [3]	1	**Yes**
132649	Dibenzofuran	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	32	0.012	U	99		100	No [4]	0.015 [7]	**Yes**
84662	Diethylphthalate	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	13	0.0095	U	0.28		66000	No [4]	480	No
206440	Fluoranthene	**1.8**	=	**1.6**	=	0.42	U	0.45	U	0.43	U	167	63	0.022	U	220		3000	No [4]	11000	No
86737	Fluorene	**0.7**	=	**0.62**	=	0.42	U	0.45	U	0.43	U	167	42	0.012	U	170		3000	No [4]	1700	No
193395	Indeno(1,2,3-cd)pyrene	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	54	0.017	U	40		2.9	**Yes** [3]	8	**Yes**
91203	Naphthalene	**1.8**	=	**1.1**	=	0.42	U	0.45	U	0.43	U	167	69	0.017	U	1700		17	**Yes** [3]	0.026	**Yes**
85018	Phenanthrene[2]	**1.7**	=	**2**	=	0.42	U	0.45	U	0.43	U	167	61	0.021	U	440		2300	No [4]	nd	No
108952	Phenol	0.39	U	0.39	U	0.42	U	0.45	U	0.43	U	167	81	0.0088	U	180		25000	No [4]	339.65	No
129000	Pyrene	**1.1**	=	**1.1**	=	0.42	U	0.45	U	0.43	U	167	63	0.021	U	160		2300	No [4]	7700	No

Table 3-2
SMA 4 - Subsurface Soil 2 - 15 ft, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CAS No.	Chemical Name	MW-54 (2-4) 12-Jul-00		MW-54 (8-10) 12-Jul-00		MW-55 (2.5-4) 11-Jul-00		MW-55 (4-6) 11-Jul-00		MW-55 (6-8) 11-Jul-00		Number of Samples	Number of Detections	Concentration Min		Concentration Max		RSL Value[1]	COPC?	SSLs Value	SSLs Exceeded?
INORGANICS (mg/kg)																					
7440360	Antimony, Total											22	7	0.54	U	1.2		47	No [4]	5.4	No
7440382	Arsenic, Total	**9.9**	=	**8.1**	=	**12**	=	**12**	=	**9.2**	=	33	33	1.5	U	18		3	**Yes** [3]	6	**Yes**
7440393	Barium, Total	**140**	=	**1600**	=	**45**	=	**26**	=	**68**	=	33	33	4.2	U	1600		22000	No [4]	1800	No
7440417	Beryllium, Total	**1.7**	=	**3.5**	=	0.6	U	0.7	U	**3.3**	=	33	14	0.05	U	3.5		230	No [4]	700	No
7440439	Cadmium, Total	**9.3**	**J**	**5.4**	**J**	**2.1**	**J**	**2.7**	**J**	**1.6**	**J**	33	32	0.06	U	11		98	No [4]	40	No
7440473	Chromium, Total	**53**	**J**	**82**	**J**	**38**	**J**	**4.3**	**J**	**28**	**J**	33	33	0.64	U	120		6.3	**Yes** [3]	36	**Yes**
7440508	Copper, Total	**39**	**J**	**7.3**	**J**	**12**	**J**	**10**	**J**	**18**	**J**	33	22	0.22	U	39		4700	No [4]	920	No
7439921	Lead, Total	**100**	**J**	**740**	**J**	**22**	**J**	**20**	**J**	**40**	**J**	33	33	0.85	U	740		800	No [4]	550	**Yes**
7440020	Nickel, Total	**10**	=	**15**	=	**9.8**	=	**8.5**	=	**23**	=	33	33	1.7	U	23		2200	No [4]	4000	No
7782492	Selenium, Total	4.7	UJ	4.7	UJ	5.1	UJ	5.5	UJ	5.3	UJ	33	3	0.11	U	1.2		580	No [4]	3.5	No
7440280	Thallium, Total	4.7	U	4.7	U	5.1	U	5.5	U	5.3	U	33	22	0.03	U	0.11		1.2	No [4]	3.3	No
7440666	Zinc, Total	**200**	**J**	**56**	**J**	**32**	**J**	**27**	**J**	**34**	**J**	33	33	1.7	U	200		35000	No [4]	28640	No
57125	Cyanide, Total	0.2	U	**0.3**	=	0.2	U	**0.6**	=	0.2	U	33	10	0.2	U	2.4		15	No [4]	40	No

U = qualifier code for nondetected result
J = qualifier code for estimated result
COPC = chemical of potential concern
SSL = groundwater protection soil screening level (Arcadis & CH2MHill, 2009)

BOLD font indicates a detected chemical concentration.

1 = USEPA, November 2015. Regional Screening Levels (RSLs).

2 = No published RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate concentration.

3 = chemical retained as a COPC because the maximum concentration exceeds the RSL

4 = chemical excluded as a COPC because the maximum concentration does not exceed the RSL

5 = chemical conservatively retained as a COPC because there is no published RSL

6 = chemical retained as a COPC because it is included in the group of potentially carcinogenic PAHs, and at least one in that group has exceeded its screening level.

7 = Source: USEPA, November 2015, RSL table.

Table 3-3
SMA 4 - Subsurface Soil, 2 - 15 ft
Refinement of Soil Screening for Leaching Potential to Groundwater
ERP Coke Facility, Birmingham, Alabama

Chemical Name	Maximum Concentration mg/kg	95% UCL mg/kg	SSL mg/kg	SSL Exceeded?	Number of Samples	Number of Detections	Frequency of Detection %	Potential Threat to Groundwater?
1,1,2-Trichloroethane	0.81	nc	0.054	Yes	177	1	0.6	No[1]
1,2-Dichloroethane	1.1	nc	0.04	Yes	177	2	1	No[1]
1,2-Dichloropropane	1.3	nc	0.06	Yes	177	1	0.6	No[1]
Benzene	1400	87.31	0.11	Yes	176	146	83	**Yes**
Carbon tetrachloride	0.35	nc	0.05	Yes	177	2	1	No[1]
Chlorobenzene	6100	270.4	3.1	Yes	177	96	54	**Yes**
Chloroform	0.0017	nc	0.0015	Yes	177	1	0.6	No[1]
cis-1,2-Dichloroethene	4.9	0.273	0.61	No	146	15	10	No[2]
cis-1,3-Dichloropropene	0.12	nc	0.01	Yes	175	2	1	No[1]
Ethylbenzene	460	26.11	40	No	177	38	21	No[2]
Methylene chloride	130	6.216	0.033	Yes	177	28	16	**Yes**
Tetrachloroethene	2	0.0578	0.08	No	177	9	5	No[1]
Toluene	56000	2744	31	Yes	177	117	66	**Yes**
Trichloroethene	0.44	0.021	0.058	No	177	8	4.5	No[2]
Vinyl chloride	3.3	0.116	0.017	Yes	177	16	9.0	**Yes**
Xylenes	2500	198.5	490	No	174	96	55	No[2]
1-Methylnaphthalene	47	3.008	0.006	Yes	134	39	29	**Yes**
2-Chlorophenol	3.4	0.0756	0.0074	Yes	167	4	2.4	No[1]
2-Methylnaphthalene	120	5.883	45	No	167	43	26	No[2]
3 & 4 Methylphenol	4	0.269	0.17	Yes	134	26	19	**Yes**
4-Methylphenol (p-cresol)	1.5	0.594	0.15	Yes	33	7	21	**Yes**
Anthracene	140	5.619	5.8	No	167	48	29	No[2]
Benzo(a)anthracene	110	5.42	1	Yes	167	56	34	**Yes**
Benzo(a)pyrene	98	4.536	16	No	167	51	31	No[2]
Benzo(b)fluoranthene	130	6.275	2	Yes	167	53	32	**Yes**
Benzo(k)fluoranthene	45	1.462	23	No	167	50	30	No[2]
Carbazole	44	1.952	0.1	Yes	134	37	28	**Yes**
Chrysene	100	4.904	69	No	167	57	34	No[2]
Dibenzo(a,h)anthracene	14	0.479	1	No	167	41	25	No[2]
Dibenzofuran	99	3.533	0.015	Yes	167	31	19	**Yes**
Indeno(1,2,3-cd)pyrene	40	1.38	8	No	167	54	32	No[2]
Naphthalene	1700	80.48	0.026	Yes	167	69	41	**Yes**
Arsenic	18	9.869	6	Yes	33	33	100	**Yes**
Chromium	120	32.7	36	No	33	33	100	No[2]
Lead	740	62.51	550	No	33	33	100	No[2]

UCL = upper confidence limit, as calculated by ProUCL

SSL = groundwater protection soil screening level (Arcadis & CH2MHill, 2009)

nc = not calculated, too few detections to calculate a UCL

1 = No, because the frequency of detection is not > 5%

2 = No, because the 95% UCL < SSL

Table 3-4
SMA 4 - Mineral Wool Pile, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, Alabama

Chemical, mg/kg	WC-MWP 01-06	WC-MWP 01-1224	WC-MWP 02-06	WC-MWP 02-1224	WC-MWP 03-06	WC-MWP 03-1224	WC-MWP 04-06	WC-MWP 04-1224	Number of Samples	Detections	Maximum Detected Concentration	COPC Sscreening			
												Industrial Workers		Resident	
												RSLs	COPC?	RSLs	COPC?
Volatile Organics															
Acetone	0.0023 U	0.0035 U	0.0029 U	0.0034 U	0.0033 U	0.0033 U	0.0038 U	0.0027 U	16	1	0.0046	67000	No	6100	No
	0.0069 U	0.0069 U	0.0049 U	**0.0046 J**	0.0066 U	0.0066 U	0.0065 U	0.0054 U							
cis-1,2-Dichloroethene	0.00032 U	0.0049 U	0.0004 U	0.00047 U	0.00046 U	0.00046 U	0.00054 U	0.00038 U	16	1	0.0015	230	No	16	No
	0.0015 J	0.0013 U	0.00091 U	0.00081 U	0.0012 U	0.0012 U	0.0012 U	0.001 U							
Methylene Chloride	0.00031 U	0.00047 U	0.00039 U	0.00045 U	0.00044 U	0.00044 U	0.00051 U	0.00036 U	16	2	0.0021	320	No	35	No
	0.0016 U	0.0016 U	0.0011 U	0.001 U	**0.0021 JB**	**0.0020 J**	0.0015 U	0.0036							
Trichloroethene	0.0003 U	0.00046 U	0.00038 U	0.00044 U	0.00043 U	0.00043 U	0.0005 U	0.00035 U	16	1	0.0014	1.9	No	0.41	No
	0.0014 J	0.0012 U	0.00086 U	0.00076 U	0.0012 U	0.0011 U	0.0011 U	0.00095 U							
Tetrachloroethene	0.00031 U	0.00047 U	0.00039 U	0.00046 U	0.00044 U	0.00045 U	0.00052 U	0.00036 U	16	2	0.0021	39	No	8.1	No
	0.0021 J	**0.0015 J**	0.0011 U	0.00097 U	0.0015 U	0.0015 U	0.0014 U	0.0012 U							
Xylenes, Total	0.001 U	0.0016 U	0.0013 U	0.0015 U	0.0015 U	0.0015 U	0.0017 U	0.0012 U	16	1	0.0011	250	No	58	No
	0.001 U	**0.0011 J**	0.00074 U	0.00066 U	0.001 U	0.00099 U	0.00099 U	0.00099 J							
Semivolatile Organics															
Benzo(a)pyrene	0.0067 U	**0.18**	0.0075 U	**0.058 J**	0.007 U	0.0078 U	0.0082 U	0.0074 U	16	3	0.18	0.29	No	0.016	**Yes**
	0.170 U	**.190** U	0.190 U	0.200 U	0.170 U	0.200 U	0.180 U	0.180 U							
Benzo(a)anthracene	0.0084 U	**0.2**	0.0095 U	**0.075 J**	0.0086 U	0.0098 U	0.010 U	0.0093 U	16	3	0.2	2.9	No	0.16	**Yes**
	0.0170 U	**0.190** U	0.190 U	0.200 U	0.170 U	0.200 U	0.180 U	0.180 U							
Benzo(b)fluoranthene	0.011 U	**0.22**	0.012 U	**0.074 J**	0.011 U	0.012 U	0.013 U	0.012 U	16	3	0.22	2.90	No	0.16	**Yes**
	0.036 U	**0.110 J**	0.039 U	0.041 U	0.035 U	0.040 U	0.038 U	0.037 U							
Chrysene	**0.0092 J**	**0.23**	0.009 U	**0.076 J**	0.0084 U	0.0093 U	0.0097 U	0.0088 U	16	4	0.23	290	No	16	**Yes**
	0.038 U	**0.160 J**	0.041 U	0.043 U	0.038 U	0.043 U	0.040 U	0.039 U							
Dibenz(a,h)anthracene	0.0075 U	**0.065 J**	0.0084 U	0.0093 U	0.0078 U	0.0087 U	0.0091 U	0.0082 U	16	1	0.065	0.29	No	0.016	**Yes**
	0.046 U	0.050 U	0.050 U	0.053 U	0.046 U	0.052 U	0.049 U	0.048 U							
Indeno(1,2,3-cd)pyrene	0.0069 U	**0.08**	0.0078 U	0.0086 U	0.0072 U	0.008 U	0.0084 U	0.0076 U	16	2	0.08	2.9	No	0.16	**Yes**
	0.040 U	**0.058 J**	0.044 U	0.046 U	0.040 U	0.045 U	0.043 U	0.041 U							
Acenaphthalene	0.0077 U	**0.013 J**	0.0086 U	0.008 U	0.008 U	0.0089 U	0.0093 U	0.0085 U	16	1	0.013	2300[1]	No	180[1]	No
	0.180 U	0.190 U	0.190 U	0.200 U	0.180 U	0.200 U	0.190 U	0.180 U							
Anthracene	0.0066 U	**0.053 J**	0.0074 U	**0.016 J**	0.0069 U	0.0076 U	0.008 U	0.0072 U	16	2	0.053	23000	No	1800	No
	0.180 U	0.190 U	0.190 U	0.200 U	0.180 U	0.200 U	0.190 U	0.180 U							
Benzo(g,hi)perylene	0.0067 U	**0.15**	0.0075 U	**0.043 J**	0.007 U	0.0078 U	0.0081 U	0.0074 U	16	3	0.15	2300[1]	No	180[1]	No
	0.045 U	**0.090 J**	0.049 U	0.052 U	0.045 U	0.390 U	0.048 U	0.047 U							
Carbazole	0.0062 U	**0.019 J**	0.007 U	0.0077 U	0.0065 U	0.0072 U	0.0075 U	0.0068 U	16	1	0.019	nd	Yes	nd	**Yes**
	0.046 U	0.050 U	0.050 U	0.053 U	0.046 U	0.052 U	0.049 U	0.048 U							
Fluoranthene	**0.0084 J**	**0.12**	0.0081 U	**0.042 J**	0.0075 U	0.0084 U	0.0087 U	0.0079 U	16	4	0.12	3000	No	240	No
	0.050 U	**0.080 J**	0.055 U	0.058 U	0.050 U	0.057 U	0.054 U	0.052 U							
2-Methylnapthalene	0.0061 U	**0.073 J**	0.0068 U	**0.019 J**	0.0063 U	0.007 U	0.0073 U	0.0067 U	16	2	0.073	300	No	24	No
	0.190 U	0.210 U	0.210 U	0.220 U	0.190 U	0.220 U	.220 U	0.200 U							
Napthalene	0.0058 U	**0.040 J**	0.0065 U	0.0072 U	0.0061 U	0.0067 U	0.007 U	0.0064 U	16	1	0.040	17	No	3.8	No
	0.036 U	0.039 U	0.039 U	0.041 U	0.035 U	0.040 U	0.038 U	0.037 U							
Phenanthrene	0.011 U	**0.19**	0.012 U	**0.060 J**	0.011 U	0.012 U	0.013 U	0.012 U	16	2	0.19	2300[1]	No	180[1]	No
	0.170 U	0.180 U	0.180 U	0.190 U	0.170 U	0.190 U	0.180 U	0.170 U							
Pyrene	**0.0074 J**	**0.18**	0.0076 U	**0.053 J**	0.0071 U	0.0079 U	0.0082 U	0.0075 U	16	3	0.18	2300	No	180	No
	0.220 U	0.160 U	0.160 U	0.170 U	0.150 U	0.170 U	0.160 U	0.150 U							

Table 3-4
SMA 4 - Mineral Wool Pile, Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, Alabama

Chemical, mg/kg	WC-MWP 01-06	WC-MWP 01-1224	WC-MWP 02-06	WC-MWP 02-1224	WC-MWP 03-06	WC-MWP 03-1224	WC-MWP 04-06	WC-MWP 04-1224	Number of Samples	Detections	Maximum Detected Concentration	COPC Sscreening Industrial Workers RSLs	Industrial Workers COPC?	Resident RSLs	Resident COPC?
Inorganics															
Arsenic	**0.11**	**0.92**	**0.7**	**1.7**	**0.16**	**0.19**	**0.33**	**0.058 J**	16	12	4.2	3.0	Yes	0.68	**Yes**
	2.4	**4.2**	**2.4**	**3.5**	**2.2**	**2.2**	**2.0**	**2.3**							
Barium	**460 B**	**380 B**	**360 B**	**380 B**	**370 B**	**370 B**	**390 B**	**360 B**	16	12	460	22000	No	1500	No
	400	**350**	**330**	**330**	**350**	**330**	**380**	**320**							
Cadmium	**1.0**	**0.89**	**1.2**	**1.5**	**1.3**	**1.3**	**1.3**	**1.4**	16	6	1.50	98	No	7.1	No
	0.11 J	0.10 U	0.098 U	0.11 U	0.095 U	0.10 U	0.10 J	0.089 U							
Chromium	**33 B**	**47 B**	**26 B**	**29 B**	**26 B**	**26 B**	**25 B**	**35 B**	16	12	47	6.3	Yes	0.30	**Yes**
	33	**41**	**29**	**30**	**28**	**25**	**23**	**34**							
Lead	**0.95 B**	**1.4 B**	**2.3 B**	**4.7 B**	1.5 **B**	**0.93 B**	**1.3 B**	**0.82 B**	16	6	4.7	800	No	400	No
	2.6 U	2.9 U	2.7 U	**4.7**	2.7 U	2.8 U	2.7 U	2.5 U							
Selenium	**0.71**	**1.3**	**1.6**	**2.3**	**1.0**	**0.91**	**0.88**	0.36 J	16	12	2.3	580	No	39	No
	1.5	**1.9**	**2.0**	**2.2**	**1.6**	**1.9**	**1.7**	**1.4**							
Silver	**0.15**	**0.15**	**0.19**	**0.23**	**0.18**	**0.19**	**0.18**	**0.19**	16	6	0.23	580	No	39	No
	0.45 U	0.49 U	0.46 U	0.50 U	0.45 U	0.48 U	0.46 U	0.42 U							
Cyanide	**3.1**	**1.1**	**2.0**	**3.0**	**3.0**	**2.1**	**3.9**	**3.0**	16	12	3.90	230	No	16	No
	2.8	**2.0**	**2.9**	**2.8**	**2.8**	**1.5**	**2.7**	**1.7**							

Bold results are detected concentrations.
USEPA results are presented on the top line per analyte and shaded gray.
USEPA results taken from Sample Analysis Report Revision 5 - Sample Collection and Analysis at the ERP Coke Facility (dated January 23, 2013). Samples collected on May 17, 2012.
ERP Coke results (splits) are presented on the bottom line per analyte and not shaded.
ERP Coke results (splits) taken from TestAmerica Analytical Report document (dated June 1, 2012). Samples collected onMay 17, 2012.
nd - no data
RSLs - Regional Screening Levels (USEPA, Nov. 2015)
U - nondetect
J - Result is less than the Reporting Limit (RL) but greater than or equal to the Method Detection Limit (MDL) and the concentration is an estimated value.
B - Analyte was found in the blank and sample.
1 = No published RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate.

Table 3-5
SMA 4 On-Site Groundwater
Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CASNumber	Chemical, µg/L	MW-49S 2/18/2014	MW-49S 5/14/2014	MW-49S 11/19/2014	MW-49S 5/20/2015	MW-49S 8/11/2015	MW-49S 11/10/2015	MW-49S 2/16/2016	MW-51 2/18/2014	MW-51 5/13/2014	MW-51 11/18/2014	MW-51 5/19/2015	MW-51 8/10/2015	MW-51 11/10/2015	MW-51 2/16/2016	MW-52 2/18/2014	MW-52 5/14/2014	MW-52 11/19/2014	MW-52 5/20/2015	MW-52 8/11/2015	MW-52 11/10/2015	MW-52 2/16/2016	MW-53 2/18/2014
75-01-4	Vinylchloride	**22**	**5.30**	**10**	**16**	**69**	**70**	**0.710 j**	**330**	**230**	**260**	**220**	**91**	**170**	**43**	0.100 u	**0.130 j**	**1.700**	**0.290 j**	**0.210 j**	**3.3000**	**0.5600 j**	**3**
67-64-1	Acetone	1.90 u	1.90 u	1.90 u	7.60 u	7.60 u	3.80 u	10 u	19 u	19 u	19 u	38 u	19 u	19 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u
75-09-2	Methylene chloride	0.32 u	0.32 u	0.32 u	1.30 u	**2.20 j b**	0.64 u	**0.40 j b**	3.20 u	3.20 u	3.20 u	6.40 u	**7.60 j b**	3.20 u	**0.390 j b**	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	**0.390 j b**	0.320 u
75-15-0	Carbon disulfide	0.45 u	0.45 u	0.45 u	1.80 u	1.80 u	0.90 u	0.45 u	4.5 u	4.5 u	4.5 u	9 u	4.5 u	4.5 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u
1634-04-4	Methyl tert butyl ether	0.25 u	0.25 u	0.25 u	1 u	1 u	0.5 u	0.25 u	2.5 u	2.5 u	2.5 u	5 u	2.5 u	2.5 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	**0.2800 j**
156-60-5	trans-1,2-Dichloroethene	0.15 u	0.15 u	0.15 u	0.60 u	**0.72 j**	0.30 u	0.15 u	**2 j**	**3.20 j**	**3.10 j**	**3 j**	**1.800 j**	**2.400 j**	**0.820 j**	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	**0.160 j**
156-59-2	cis-1,2-Dichloroethene	**3.20**	**1.30**	**0.57 j**	**15**	**88**	**14**	**0.17 j**	**67**	**120**	**260**	**170**	**88**	**150**	**5**	0.1500 u	0.1500 u	**3.200**	**0.170 j**	**0.360 j**	**6.300**	**0.620 j**	**0.190 j**
78-93-3	2-Butanone	2 u	2 u	2 u	8 u	8 u	4 u	2 u	20 u	20 u	20 u	40 u	20 u	20 u	2 u	2 u	2 u	2 u	2 u	**2.5 j**	2 u	2 u	2 u
71-43-2	Benzene	**5.30**	**2.40**	**1.40**	**22**	**6**	**5.400**	**0.790 j**	**7.5 j**	**10**	**14**	**10 j**	**8 j**	**12**	**3.600**	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.1600 u	**3.5**
107-06-2	1,2-Dichloroethane	0.13 u	0.13 u	0.13 u	0.52 u	0.52 u	0.260 u	0.130 u	1.300 u	1.300 u	1.300 u	2.600 u	1.300 u	1.300 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.1300 u	0.1300 u	0.130 u
79-01-6	Trichloroethene	0.16 u	0.16 u	0.16 u	**0.89 j**	**1.30 j**	0.320 u	0.160 u	1.600 u	1.600 u	1.600 u	3.200 u	1.600 u	1.600 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.1600 u	0.160 u
108-10-1	4-Methyl-2-pentanone	0.98 u	0.98 u	0.98 u	3.90 u	3.90 u	2 u	0.980 u	9.800 u	9.800 u	9.800 u	20 u	9.800 u	9.800 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.9800 u	0.9800 u	0.980 u
108-88-3	Toluene	0.17 u	**0.20 j**	**0.18 j**	**72**	**0.810 j**	**0.620 j**	**0.290 j**	1.700 u	1.700 u	**1.800 j**	3.400 u	10 u	1.70 u	0.17 u	0.17 u	0.17 u	0.170 u	0.170 u	0.170 u	**0.2400 j**	0.1700 u	**0.210 j**
108-90-7	Chlorobenzene	**1.90**	**1.70**	**2.30**	**7.300**	**2.900 j**	**2.200**	**1.600**	1.700 u	1.700 u	1.700 u	3.400 u	1.70 u	1.70 u	**0.68 j**	**1.80**	**2.20**	**2.100**	**1.700**	**1.700**	**1.6000**	**1.5**	**12**
100-41-4	Ethylbenzene	0.16 u	0.16 u	0.16 u	0.640 u	0.640 u	0.320 u	0.160 u	1.600 u	1.600 u	1.600 u	3.200 u	1.60 u	1.60 u	0.16 u	0.16 u	0.16 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.160 u	0.160 u
	m,p-Xylenes	0.34 u	0.34 u	0.34 u	1.400 u	1.400 u	0.680 u	0.340 u	3.400 u	3.400 u	3.400 u	6.800 u	3.40 u	3.40 u	0.34 u	0.34 u	0.34 u	0.340 u	0.340 u	0.340 u	0.3400 u	0.340 u	0.340 u
95-47-6	o-Xylene	0.19 u	0.19 u	0.19 u	**1.100 j**	0.760 u	0.380 u	0.190 u	1.900 u	1.900 u	1.900 u	3.800 u	10 u	1.900 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u
100-42-5	Styrene	0.17 u	0.17 u	0.17 u	0.680 u	0.680 u	0.340 u	0.170 u	1.700 u	1.700 u	1.700 u	3.400 u	**2.10 j**	1.70 u	0.17 u	0.17 u	0.17 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u
98-82-8	Isopropylbenzene (Cumene)	0.19 u	0.19 u	0.19 u	0.760 u	0.760 u	0.380 u	0.190 u	1.900 u	1.900 u	1.900 u	3.800 u	10 u	1.900 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u
123-91-1	1,4-Dioxane	1.60 u	1.60 u	1.60 u	1.600 u	230 u	110 u	57 u	**1.800 j**	570 u	570 u	1100 u	570 u	570 u	57 u	57 u	**3.30 j**	57 u	57 u	57 u	57 u	57 u	57 u
108-87-2	Cyclohexane, Methyl-	0.36 u	0.36 u	0.36 u	1.400 u		0.72 u	0.36 u	3.60 u	3.600 u	3.600 u	7.200 u	10 u	3.60 u	**0.36 j**	0.36 u	0.36 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u
	3/4-Methylphenol	0.24 u	0.24 u	0.24 u	**0.850 j**				0.24 u	0.240 u	0.240 u	0.240 u				**0.290 j**	**0.300 j**	0.240 u	**0.350 j**				0.240 u
120-82-1	1,2,4-Trichlorobenzene	**0.27 u**	**0.27 u**	**0.27 u**	**0.840 u**	**0.84 u**	**0.42 u**	**0.21 u**	**2.10 u**	**2.100 u**	**2.100 u**	**0.270 u**	**2.10 u**	**2.10 u**	**0.21 u**	**0.21 u**	**0.21 u**	**0.210 u**	**0.270 u**	**0.210 u**	**0.210 u**	**0.210 u**	**0.270 u**
95-50-1	1,2-Dichlorobenzene	0.22 u	0.22 u	0.15 u	0.220 u	0.60 u	0.30 u	0.15 u	1.5 u	0.220 u	1.5 u	3 u	1.5 u	1.5 u	0.150 u	0.150 u	0.150 u	0.150 u	0.220 u	0.150 u	0.150 u	0.150 u	0.220 u
541-73-1	1,3-Dichlorobenzene	**0.28 u**	**0.13 u**	**0.13 u**	**0.520 u**				**0.280 u**	**1.300 u**	**1.300 u**	**2.600 u**				**0.130 u**	**0.280 u**	**0.290 u**	**0.130 u**				**0.290 u**
106-46-7	1,4-Dichlorobenzene	0.30 u	0.16 u	0.30 u	0.310 u				0.300 u	1.600 u	0.300 u	0.310 u				0.300 u	0.300 u	0.300 u	0.310 u				**0.200 j**
105-67-9	2,4-Dimethylphenol	0.55 u	0.55 u	0.55 u	0.550 u				0.550 u	0.550 u	0.550 u	0.550 u				0.550 u	0.550 u	0.550 u	0.560 u				0.55 u
95-57-8	2-Chlorophenol	1.90 u	1.90 u	1.90 u	1.90 u				1.90 u	1.90 u	1.90 u	1.90 u				1.90 u	1.90 u	1.90 u	1.90 u				1.90 u
95-48-7	2-Methylphenol	0.93 u	0.93 u	0.93 u	**1.10 j**				0.93 u	0.93 u	0.93 u	0.93 u				0.93 u	0.93 u	0.93 u	0.94 u				0.93 u
98-86-2	Acetophenone	0.23 u	0.23 u	0.23 u	0.23 u				0.23 u	0.23 u	0.23 u	0.23 u				0.230 u	0.230 u	0.230 u	0.230 u				0.23 u
100-51-6	Benzyl alcohol	0.22 u	0.22 u	0.22 u	0.22 u				0.22 u	0.22 u	0.22 u	0.22 u				0.220 u	0.220 u	0.220 u	0.220 u				0.22 u
86-74-8	Carbazole	0.41 u	0.41 u	0.41 u	0.41 u				0.41 u	0.41 u	0.41 u	0.41 u				0.410 u	0.410 u	0.410 u	0.410 u				0.41 u
132-64-9	Dibenzofuran	0.27 u	0.28 u	0.28 u	0.28 u				0.28 u	0.27 u	0.28 u	0.28 u				0.280 u	0.280 u	0.280 u	0.280 u				0.28 u
131-11-3	Dimethyl phthalate	0.20 u	0.20 u	0.20 u	0.20 u				0.20 u	0.20 u	0.20 u	0.20 u				0.200 u	0.200 u	0.200 u	0.200 u				0.20 u
87-86-5	Pentachlorophenol	19 u	19 u	19 u	19 u				19 u	19 u	19 u	19 u				19 u	19 u	19 u	19 u				19 u
108-95-2	Phenol	1.90 u	1.90 u	1.90 u	**3.40 j**				1.90 u	**2.90 j**	1.90 u	**3.20 j**				1.90 u	1.90 u	1.9 u	1.9 u				1.90 u
129-00-0	Pyrene	0.0076 u	0.008 u	0.0077 u	0.0077 u				0.0076 u	**0.021 j**	**0.039 j**	**0.027 j**				0.0077 u	0.0077 u	0.0077 u	0.0077 u				**0.10**
91-20-3	Naphthalene								0.0049 u	0.0049 u	0.0049 u	0.0049 u				0.0051 u	0.0051 u	0.0051 u	**0.0160 j**				0.0051 u
91-57-6	2-Methylnaphthalene	**0.0320 j**	**0.0320 j**	0.01 u	**0.0410 j**				**0.84**	**0.93**	**1.40**	**1.10**				0.0049 u	0.0049 u	0.0049 u	0.0049 u				0.0049 u
83-32-9	Acenaphthene	0.0094 u	0.0098 u	0.0095 u	0.0095 u				**0.038 j**	**0.036 j**	0.0095 u	0.0095 u				**0.380**	**0.540**	**0.920**	**0.390**				**9.5**
208-96-8	Acenaphthylene[2]	0.0130 u	0.0140 u	0.014 u	0.014 u				**0.034 j**	**0.054 j**	**0.063 j**	**0.047 j**				0.0095 u	0.0094 u	0.0095 u	0.0095 u				0.0095 u
120-12-7	Anthracene	0.0030 u	0.0032 u	0.0031 u	0.0031 u				0.003 u	0.0031 u	0.0031 u	0.0031 u				0.014 u	0.013 u	0.014 u	0.013 u				0.013 u
56-55-3	Benz(a)anthracene	0.0049 u	0.0051 u	0.0049 u	0.0049 u				0.0049 u	0.0049 u	0.0049 u	0.0049 u				0.0031 u	0.003 u	0.0031 u	0.0031 u				0.003 u
50-32-8	Benzo(a)pyrene	0.0033 u	0.0034 u	0.0033 u	0.0033 u				0.0033 u	0.0033 u	0.0033 u	0.0033 u				0.0049 u	0.0049 u	0.0049 u	0.0049 u				0.0049 u
205-99-2	Benzo(b)fluoranthene	0.0034 u	0.0035 u	0.0034 u	0.0034 u				0.0034 u	0.0034 u	0.0034 u	0.0034 u				0.0033 u	0.0033 u	0.0033 u	0.0033 u				0.0033 u
191-24-2	Benzo(g,h,i)perylene[2]	0.0048 u	0.0050 u	0.0048 u	0.0048 u				0.0048 u	0.0048 u	0.0048 u	0.0048 u				0.0034 u	0.0034 u	0.0034 u	0.0034 u				0.0034 u
207-08-9	Benzo(k)fluoranthene	0.0030 u	0.0031 u	0.003 u	0.003 u				0.003 u	0.003 u	0.0031 u	0.0031 u				0.0048 u	0.0048 u	0.0048 u	0.0048 u				0.0048 u
218-01-9	Chrysene	0.0046 u	0.0048 u	0.0046 u	0.0046 u				0.0046 u	0.0046 u	0.0046 u	0.0046 u				0.003 u	0.003 u	0.003 u	0.003 u				0.003 u
53-70-3	Dibenz(a,h)anthracene	0.0043 u	0.0045 u	0.0043 u	0.0043 u				0.0043 u	**0.036 j**	**0.071 j**	**0.051 j**				0.0046 u	0.0046 u	0.0046 u	0.0046 u				0.0046 u
206-44-0	Fluoranthene	0.0180 u	0.0190 u	0.018 u	0.018 u				**0.024 j**	**0.043 j**	**0.040 j**	**0.032 j**				0.0043 u	0.0043 u	0.0043 u	0.0043 u				**0.230**
86-73-7	Fluorene	0.014 u	0.015 u	0.014 u	0.014 u				0.014 u	0.014 u	0.014 u	0.014 u				0.018 u	0.018 u	0.018 u	0.018 u				**1.100**
193-39-5	Indeno(1,2,3-cd)pyrene	1.60 u	1.60 u	1.60 u	6.60 u	6.60 u	3.30 u	1.60 u	16 u	16 u	16 u	33 u	16 u	16 u	1.600 u	0.014 u	0.014 u	0.014 u	0.014 u				0.014 u
79-20-9	Methyl Acetate					1.10 u	0.56 u	0.28 u					20 u	2.80 u	**0.5 j**	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u
110-82-7	Cyclohexane																			0.28 u	0.28 u	0.28 u	0.28 u

RSL = Regional Screening Levels VISL = Vapor Intrusion Screening Levels

COPC = chemical of potential concern, chemical retained as a COPC if the maximum concentration exceeds the screening level

VISL = Vapor Intrusion Screening Levels, from USEPA, 2014. Vapor Intrusion Screening Level Calculator

nd = no data, chemical is not volatile as presented in the VISL Calculator

1 = screening levels are tapwater USEPA RSLs (Nov. 2015), or maximum contaminant levels for those chemicals without tapwater values.

2 = no published RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate.

3 = chemical retained as a COPC as the maximum detected concentration exceeds the RSL

4 = chemical eliminated as a COPC as the maximum detected concentration does not exceed the RSL

5 = chemical conservatively retained as a COPC because no published screening value is available

6 = retained as a COPC because it is included in the group of potentially carcinogenic PAHs and at least one in that group has exceeded its screening level

Table 3-5
SMA 4 On-Site Groundwater
Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CASNumber	Chemical, µg/L	MW-53 5/13/2014	MW-53 11/18/2014	MW-53 5/19/2015	MW-53 8/10/2015	MW-53 11/10/2015	MW-53 2/16/2016	MW-54 2/18/2014	MW-54 5/13/2014	MW-54 11/18/2014	MW-54 5/19/2015	MW-54 8/11/2015	MW-54 11/10/2015	MW-54 2/17/2016	MW-55 2/18/2014	MW-55 5/14/2014	MW-55 11/19/2014	MW-55 5/20/2015	MW-55 8/11/2015	MW-55 11/10/2015	MW-55 2/16/2016	MW-56 2/19/2014
75-01-4	Vinylchloride	**1.800**	**0.850 j**	**1.200**	**0.580 j**	**0.890 j**	**0.910 j**	4 u	10 u	5 u	10 u	4 u	2 u	1 u	400 u	800 u	400 u	400 u	400 u	1000 u	200 u	50 u
67-64-1	Acetone	**6.5 jb**	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	76 u	190 u	95 u	190 u	76 u	38 u	19 u	7600 u	15000 u	7600 u	7600 u	**13000 j b**	19000 u	3800 u	**1600 jb**
75-09-2	Methylene chloride	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	**0.460 j b**	13 u	32 u	16 u	32 u	**25 j b**	6.4 u	**4 j b**	1300 u	2600 u	1300 u	1300 u	1300 u	3200 u	**830 j b**	**450 jb**
75-15-0	Carbon disulfide	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	18 u	45 u	23 u	45 u	18 u	9 u	4.5 u	1800 u	3600 u	1800 u	1800 u	1800 u	4500 u	900 u	230 u
1634-04-4	Methyl tert butyl ether	**0.2600 j**	0.25 u	0.25 u	0.25 u	0.25 u	**0.270 j**	10 u	25 u	13 u	25 u	10 u	5 u	2.5 u	1000 u	2000 u	1000 u	1000 u	1000 u	2500 u	500 u	130 u
156-60-5	trans-1,2-Dichloroethene	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	6 u	15 u	7.5 u	15 u	6 u	3 u	1.5 u	600 u	1200 u	600 u	600 u	600 u	1500 u	300 u	75 u
156-59-2	cis-1,2-Dichloroethene	**0.230 j**	**0.150 j**	**0.170 j**	0.150 u	0.150 u	0.150 u	6 u	**20 j**	7.5 u	15 u	6 u	3 u	1.5 u	600 u	1200 u	600 u	600 u	600 u	1500 u	300 u	75 u
78-93-3	2-Butanone	2 u	2 u	2 u	2 u	2 u	2 u	80 u	200 u	100 u	200 u	80 u	40 u	20 u	8000 u	16000 u	8000 u	8000 u	8000 u	20000 u	4000 u	1000 u
71-43-2	Benzene	**5**	**4.9000**	**2.2000**	**0.3500 j**	**1.4000**	**0.75 j**	6.40 u	**35 j**	8 u	**80 j**	6.40 u	3.20 u	1.60 u	**42000**	**61000**	**49000**	**58000**	**59000**	**46000**	**53000**	**14000**
107-06-2	1,2-Dichloroethane	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	5.20 u	13 u	6.5 u	13 u	5.20 u	2.60 u	1.30 u	520 u	1000 u	520 u	520 u	520 u	1300 u	260 u	65 u
79-01-6	Trichloroethene	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	6.40 u	**20 j**	8 u	16 u	6.40 u	3.20 u	1.60 u	640 u	1300 u	640 u	640 u	640 u	1600 u	320 u	80 u
108-10-1	4-Methyl-2-pentanone	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	39 u	98 u	49 u	98 u	39 u	20 u	9.80 u	3900 u	7800 u	3900 u	3900 u	3900 u	9800 u	2000 u	490 u
108-88-3	Toluene	**0.180 j**	0.170 u	0.170 u	0.170 u	**0.25 j**	0.170 u	6.80 u	**74 j**	8.5 u	17 u	6.80 u	3.40 u	1.70 u	**42000**	**56000**	**46000**	**35000**	**45000**	**43000**	**28000**	85 u
108-90-7	Chlorobenzene	**12**	**10**	**11**	**8.900**	**8.5**	**8.100**	**990**	**1500**	**970**	**2300**	**1000**	**560**	**470**	**140000**	**160000**	**130000**	**120000**	**140000**	**130000**	**110000**	**3900**
100-41-4	Ethylbenzene	**0.25 j**	**0.220 j**	0.160 u	0.160 u	0.160 u	0.160 u	6.40 u	16 u	8 u	16 u	6.40 u	3.20 u	1.60 u	640 u	1300 u	640 u	640 u	640 u	1600 u	320 u	80 u
	m,p-Xylenes	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	14 u	**55 j**	17 u	34 u	14 u	6.80 u	3.40 u	1400 u	2700 u	1400 u	1400 u	1400 u	3400 u	**690 j**	170 u
95-47-6	o-Xylene	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	7.600 u	19 u	9.5 u	19 u	7.60 u	3.80 u	1.90 u	760 u	1500 u	760 u	760 u	760 u	1900 u	380 u	95 u
100-42-5	Styrene	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	6.800 u	17 u	8.5 u	17 u	6.80 u	3.40 u	1.70 u	680 u	1400 u	680 u	680 u	680 u	1700 u	340 u	85 u
98-82-8	Isopropylbenzene (Cumene)	0.190 u	0.190 u	**0.190 j**	0.190 u	0.190 u	0.190 u	7.600 u	19 u	9.5 u	19 u	7.60 u	3.80 u	1.90 u	760 u	1500 u	760 u	760 u	760 u	1900 u	380 u	95 u
123-91-1	1,4-Dioxane	1.600 u	1.600 u	1.600 u	57 u	57 u	57 u	1.60 u	1.60 u	2900 u	5700 u	2300 u	1100 u	570 u	1.60 u	460000 u	230000 u	1.60 u	230000 u	570000 u	110000 u	29000 u
108-87-2	Cyclohexane, Methyl-	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	14 u	36 u	18 u	36 u	14 u	7.20 u	3.60 u	1400 u	2900 u	1400 u	1400 u		3600 u	720 u	180 u
	3/4-Methylphenol	**0.360 j**	**0.340 j**	0.240 u				0.240 u	**2.400 j**	0.240 u	0.240 u				**42**	**40**	**29**	**23**				**2.60 j**
120-82-1	1,2,4-Trichlorobenzene	**0.270 u**	**0.270 u**	**0.270 u**	**0.21 u**	**0.21 u**	**0.21 u**	**8.40 u**	**0.27 u**	**11 u**	**0.270 u**	**8.40 u**	**4.20 u**	**2.10 u**	**840 u**	**460**	**840 u**	**440**	**840 u**	**2100 u**	**420 u**	**110 u**
95-50-1	1,2-Dichlorobenzene	0.150 u	0.150 u	0.150 u	0.15 u	0.15 u	0.15 u	6 u	15 u	0.22 u	15 u	6 u	3 u	1.5 u	600 u	1200 u	**3.90**	**0.220** u	600 u	1500 u	300 u	75 u
541-73-1	1,3-Dichlorobenzene	**0.210 j**	**0.220 j**	**0.280 u**				**0.280 u**	**13 u**	**6.5 u**	**0.290 u**				**6.70 j**	**7 j**	**8.40 j**	**0.29 u**				**65 u**
106-46-7	1,4-Dichlorobenzene	**0.270 j**	**0.290 j**	**0.200 j**				0.300 u	16 u	0.300 u	0.310 u				640 u	**420**	**430**	**560**				**5.200 j**
105-67-9	2,4-Dimethylphenol	0.55 u	0.55 u	0.55 u				0.550 u	0.550 u	0.550 u	0.550 u				**1.10 j**	**0.99 j**	0.55 u	**0.840 j**				2.200 u
95-57-8	2-Chlorophenol	1.90 u	1.90 u	1.90 u				1.90 u	1.90 u	**1.90 j**	1.90 u				**39**	**26**	**17**	**21**				7.600 u
95-48-7	2-Methylphenol	0.93 u	0.93 u	0.93 u				0.93 u	0.93 u	0.93 u	0.94 u				**28**	**30**	**14**	**15**				3.700 u
98-86-2	Acetophenone	0.23 u	0.23 u	0.23 u				0.23 u	0.23 u	0.23 u	0.23 u				0.23 u	**4.20 j**	**3.10 j**	**4.20 j**				0.910 u
100-51-6	Benzyl alcohol	0.22 u	0.22 u	0.22 u				0.22 u	0.22 u	0.22 u	0.22 u				**1.600 j**	**1.5 j**	**0.66 j**	0.22 u				0.870 u
86-74-8	Carbazole	0.41 u	0.41 u	0.41 u				0.41 u	0.41 u	0.41 u	0.41 u				**1.100 j**	**1.30 j**	**1.30 j**	**1.40 j**				1.600 u
132-64-9	Dibenzofuran	**0.33 j**	0.28 u	0.28 u				0.28 u	0.28 u	0.27 u	0.28 u				**0.810 j**	**1 j**	**1.200 j**	**1.30 j**				**3.700 j**
131-11-3	Dimethyl phthalate	**0.42 jb**	0.20 u	0.20 u				0.20 u	0.20 u	0.20 u	0.20 u				0.200 u	0.200 u	0.200 u	0.20 u				0.800 u
87-86-5	Pentachlorophenol	19 u	19 u	19 u				19 u	19 u	19 u	19 u				19 u	19 u	19 u	19 u				76 u
108-95-2	Phenol	1.90 u	**5.80 j**	1.90 u				1.90 u	**3.70 j**	1.90 u	1.90 u				**170**	**270**	**87**	**130**				**18 j**
129-00-0	Pyrene	**0.08 j**	**0.11**	**0.088 j**				**1.300**	**1**	**1.20**	**1**				**0.24**	**0.29**	**0.23**	**0.210**				**1**
91-20-3	Naphthalene	**0.009 j**	0.0051 u	0.0051 u				**0.039 j**	**0.120**	0.005 u	0.0051 u				**22**	**22**	**29**	**30**				**8.10**
91-57-6	2-Methylnaphthalene	0.0049 u	0.0049 u	0.0049 u				**0.015 j**	**0.012 j**	**0.044 j**	0.0049 u				**1.10**	**1.40**	**1.40**	**1.40**				**0.63**
83-32-9	Acenaphthene	**7.40**	**7.60**	**7.80**				**14**	**13**	**10**	**11**				**0.69**	**0.83**	**0.78**	**0.81**				**4.90**
208-96-8	Acenaphthylene[2]	**0.11**	**0.10**	**0.10**				0.0094 u	**0.09**	**0.08 j**	0.0095 u				**0.06 j**	**0.07 j**	**0.08 j**	**0.09 j**				**0.16**
120-12-7	Anthracene	**0.059 j**	0.014 u	**0.040 j**				**0.220**	**0.21**	**0.24**	**0.200**				**0.25**	**0.320**	**0.300**	**0.23**				**0.59**
56-55-3	Benz(a)anthracene	0.0031 u	0.0031 u	0.0031 u				**0.220**	**0.21**	**0.28**	**0.180**				**0.048 j**	**0.0470 j**	0.003 u	**0.03 j**				**0.53**
50-32-8	Benzo(a)pyrene	0.0049 u	0.0049 u	0.0049 u				**0.028 j**	**0.05 j**	**0.13**	**0.030 j b**				**0.021 j**	**0.0190 j**	0.0049 u	**0.02 j**				**0.5**
205-99-2	Benzo(b)fluoranthene	0.0033 u	0.0033 u	0.0033 u				**0.056 j**	**0.09 j**	**0.23**	**0.058 j b**				**0.028 j**	**0.0280 j**	0.0033 u	**0.021 j**				**0.650**
191-24-2	Benzo(g,h,i)perylene[2]	0.0034 u	0.0034 u	0.0034 u				**0.0074 j**	**0.023 j**	**0.083 j**	**0.017 j**				**0.01 j**	**0.0082 j**	0.0034 u	**0.0087 j**				**0.510**
207-08-9	Benzo(k)fluoranthene	0.0048 u	0.0048 u	0.0048 u				**0.023 j**	**0.026 j**	**0.083 j**	**0.016 j b**				**0.015 j**	**0.011 j**	0.0048 u	**0.0078 j**				**0.180**
218-01-9	Chrysene	0.003 u	0.003 u	0.003 u				**0.160**	**0.140**	**0.240**	**0.086 j**				**0.048 j**	**0.049 j**	0.003 u	**0.033 j**				**1**
53-70-3	Dibenz(a,h)anthracene	0.0046 u	0.0046 u	0.0046 u				0.0046 u	**0.0066 j**	**0.02 j**	0.0046 u				0.0046 u	0.0046 u	0.0046 u	0.0046 u				**0.20**
206-44-0	Fluoranthene	**0.170**	**0.230**	**0.190**				**2**	**1.40**	**1.70**	**1.30**				**0.470**	**0.5**	**0.430**	**0.37**				**1.40**
86-73-7	Fluorene	**0.880**	**0.590**	**0.410**				**0.220**	**0.18**	**0.17**	0.02 u				**1.200**	**1.40**	**1.30**	**1.40**				**7**
193-39-5	Indeno(1,2,3-cd)pyrene	0.014 u	0.014 u	0.014 u				0.014 u	0.024 j	**0.089 j**	**0.018 j**				0.014 u	0.014 u	0.014 u	0.014 u				**0.32**
79-20-9	Methyl Acetate	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	66 u	160 u	82 u	160 u	66 u	33 u	16 u	6600 u	13000 u	6600 u	6600 u	6600 u	16000 u	3300 u	820 u
110-82-7	Cyclohexane	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	11 u	28 u	14 u	28 u	11 u	5.60 u	2.80 u	1100 u	2200 u	1100 u	1100 u	1100 u	2800 u	560 u	140 u

RSL = Regional Screening Levels
COPC = chemical of potential concern, chemical retained as a COPC if the maximum concentration exceeds the screening level
VISL = Vapor Intrusion Screening Levels, from USEPA, 2014. Vapor Intrusion Screening Level Calculator
nd = no data, chemical is not volatile as presented in the VISL Calculator
1 = screening levels are tapwater USEPA RSLs (Nov. 2015), or maximum contaminant levels for those chemicals without tapwater values.
2 = no published RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate.
3 = chemical retained as a COPC as the maximum detected concentration exceeds the RSL
4 = chemical eliminated as a COPC as the maximum detected concentration does not exceed the RSL
5 = chemical conservatively retained as a COPC because no published screening value is available
6 = retained as a COPC because it is included in the group of potentially carcinogenic PAHs and at least one in that group has exceeded its screening level

Table 3-5
SMA 4 On-Site Groundwater
Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CASNumber	Chemical, µg/L	MW-56 11/19/2014	MW-56 5/20/2015	MW-56 8/11/2015	MW-56 11/11/2015	MW-56 2/16/2016	MW-77 2/18/2014	MW-77 5/13/2014	MW-77 11/18/2014	MW-77 5/19/2015	MW-78 2/19/2014	MW-78 5/14/2014	MW-78 11/19/2014	MW-78 5/20/2015	MW-78 8/12/2015	MW-78 11/11/2015	MW-78 2/17/2016	MW-80 2/19/2014	MW-80 5/13/2014	MW-80 11/18/2014	MW-80 5/19/2015	MW-81 2/19/2014	MW-81 5/13/2014
75-01-4	Vinylchloride	20 u	10 u	20 u	10 u	20 u	0.100 u	0.100 u	0.100 u	0.100 u	0.100 u	**0.550 j**	**0.340 j**	**0.290 j**	**0.240 j**	**0.260 j**	**0.490 j**	0.1000 u	0.1000 u	0.1000 u	0.1000 u	2 u	1
67-64-1	Acetone	380 u	190 u	380 u	190 u	380 u	1.900 u	**7.300 jb**	1.900 u	1.900 u	**2.600 jb**	**7.600 jb**	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	**2.1000 jb**	**5.6000 jb**	1.9000 u	1.9000 u	**54 jb**	19
75-09-2	Methylene chloride	64 u	32 u	**120 j b**	32 u	**180 j b**	0.320 u	0.320 u	0.320 u	0.320 u	**0.320 jb**	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	0.3200 u	0.3200 u	0.3200 u	0.3200 u	**16 jb**	3.20
75-15-0	Carbon disulfide	90 u	45 u	90 u	45 u	90 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.4500 u	0.4500 u	0.4500 u	0.4500 u	9 u	4.5
1634-04-4	Methyl tert butyl ether	50 u	25 u	50 u	25 u	50 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	5 u	2.5
156-60-5	trans-1,2-Dichloroethene	30 u	15 u	30 u	15 u	30 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	3 u	1.5
156-59-2	cis-1,2-Dichloroethene	30 u	15 u	30 u	15 u	30 u	0.150 u	0.150 u	0.150 u	0.150 u	**0.310 j**	**0.460 j**	**0.460 j**	**0.440 j**	**0.590 j**	**0.430 j**	**0.420 j**	0.150 u	0.150 u	0.150 u	0.150 u	3 u	1.5
78-93-3	2-Butanone	400 u	200 u	400 u	200 u	400 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	40 u	20
71-43-2	Benzene	**8700**	**82 j**	**250**	**1600**	**6500**	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	**460**	**240**
107-06-2	1,2-Dichloroethane	26 u	13 u	26 u	**75 j**	26 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.1300 u	0.1300 u	0.1300 u	0.1300 u	2.600 u	1.300
79-01-6	Trichloroethene	32 u	16 u	32 u	16 u	32 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	3.200 u	1.600
108-10-1	4-Methyl-2-pentanone	200 u	98 u	200 u	98 u	200 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.9800 u	0.9800 u	0.9800 u	0.9800 u	20 u	9.800
108-88-3	Toluene	**510**	17 u	34 u	**30 j**	**34 j**	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	3.400 u	1.700
108-90-7	Chlorobenzene	**3800**	**1700**	**3000**	**2600**	**3000**	0.170 u	0.170 u	0.170 u	0.170 u	**0.410 j**	**0.710 j**	**0.550 j**	**0.470 j**	**0.510 j**	**0.320 j**	**0.530 j**	0.1700 u	0.1700 u	0.1700 u	0.1700 u	**4.700 j**	**5.400**
100-41-4	Ethylbenzene	32 u	16 u	32 u	16 u	32 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	3.200 u	1.600
	m,p-Xylenes	68 u	34 u	68 u	34 u	68 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.3400 u	0.3400 u	0.3400 u	0.3400 u	6.800 u	3.400
95-47-6	o-Xylene	38 u	19 u	38 u	19 u	38 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	3.800 u	1.900
100-42-5	Styrene	34 u	17 u	34 u	17 u	34 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	3.400 u	1.700
98-82-8	Isopropylbenzene (Cumene)	38 u	19 u	38 u	19 u	38 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	**65**	**56**
123-91-1	1,4-Dioxane	1.600 u	5700 u	11000 u	5700 u	11000 u	57 u	1.600 u	57 u	1.600 u	1.600 u	1.600 u	1.600 u	57 u	57 u	57 u	57 u	**1.7000 j**	1.6000 u	1.6000 u	**1.9000 j**	1100 u	570
108-87-2	Cyclohexane, Methyl-	72 u	36 u	72 u	36 u	72 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u		0.360 u	0.360 u	0.3600 u	0.3600 u	0.3600 u	0.3600 u	7.200 u	**4.300**
	3/4-Methylphenol	**3.20 j**	**1.30 j**				0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	**0.700 j**	**0.350 j**	0.240 u				**0.75 j**	**0.3400 j**	**0.6300 j**	**0.7000 j**	**0.290 j**	0.240
120-82-1	1,2,4-Trichlorobenzene	**0.270 u**	**0.270 u**	**42 u**	**21 u**	**42 u**	**0.210 u**	**0.270 u**	**0.270 u**	**0.270 u**	**0.270 u**	**2.100 j**	**0.640 j**	**0.210 u**	**0.210 u**	**0.210 u**	**0.210 u**	**0.2700 u**	**0.2700 u**	**0.2700 u**	**0.2100 u**	**4.200 u**	**0.270**
95-50-1	1,2-Dichlorobenzene	30 u	15 u	30 u	15 u	30 u	0.150 u	0.220 u	0.220 u	0.220 u	0.150 u	0.150 u	0.220 u	0.150 u	0.150 u	0.150 u	0.150 u	0.1500 u	0.2200 u	0.2200 u	0.1500 u	3 u	0.220
541-73-1	1,3-Dichlorobenzene	**0.280 u**	**13 u**				**0.130 u**	**0.130 u**	**0.280 u**	**0.280 u**	**0.270 j**	**0.200 j**	**0.210 j**	**0.290 u**				**0.2900 u**	**0.1300 u**	**0.2800 u**	**0.2800 u**	**0.280 u**	**0.290**
106-46-7	1,4-Dichlorobenzene	**1.900 j**	16 u				0.160 u	0.160 u	0.300 u	0.160 u	**0.590 j**	**2.600 j**	**0.510 j**	**0.470 j**				0.3000 u	0.3000 u	0.3000 u	0.1600 u	0.300 u	1.600
105-67-9	2,4-Dimethylphenol	**1 j**	0.56 u				0.550 u	0.550 u	0.550 u	0.550 u	0.550 u	0.550 u	0.550 u	0.550 u				0.5500 u	0.5500 u	0.5500 u	0.5500 u	0.550 u	0.550
95-57-8	2-Chlorophenol	1.900 u	1.900 u				1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u				1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900
95-48-7	2-Methylphenol	**3.600 j**	0.940 u				0.930 u	0.930 u	0.930 u	0.930 u	0.930 u	0.930 u	0.930 u	0.930 u				0.930 u	0.930 u	0.930 u	0.930 u	0.930 u	0.930
98-86-2	Acetophenone	0.230 u	0.230 u				0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	**0.340 j**	0.230 u	0.230 u				0.23 u	0.23 u	0.23 u	0.23 u	**0.26 j**	0.23
100-51-6	Benzyl alcohol	0.220 u	0.220 u				0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u				0.22 u	0.22 u	0.22 u	0.22 u	0.22 u	0.22
86-74-8	Carbazole	**0.440 j**	0.410 u				0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u				0.41 u	0.41 u	0.41 u	0.41 u	0.41 u	0.41
132-64-9	Dibenzofuran	**3.400 j**	**1.700 j**				0.280 u	0.280 u	0.280 u	0.270 u	0.280 u	0.270 u	0.280 u	0.280 u				0.28 u	0.28 u	0.28 u	0.28 u	0.27 u	0.28
131-11-3	Dimethyl phthalate	0.200 u	0.200 u				0.200 u	**0.530 jb**	0.200 u	0.200 u	0.200 u	0.200 u	0.200 u	0.200 u				0.20 u	0.20 u	0.20 u	0.20 u	0.20 u	0.20
87-86-5	Pentachlorophenol	19 u	**21 j**				19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u				19 u	19 u	19 u	19 u	19 u	19
108-95-2	Phenol	**13**	**8.70 j**				1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	**2 j**	1.90 u	1.90 u				1.90 u	1.90 u	1.90 u	1.90 u	**4 j**	**2**
129-00-0	Pyrene	**0.310**	**0.25**				0.0078 u	0.0077 u	0.0077 u	0.0079 u	0.0077 u	0.0076 u	0.0078 u	0.0077 u				0.0076 u	0.0077 u	0.0076 u	**0.03 j**	**0.28**	**0.27**
91-20-3	Naphthalene	**17**	**1.30**				0.0051 u	**0.0074 j**	0.0051 u	0.0052 u	0.0051 u	0.005 u	0.0051 u	0.0051 u				0.005 u	0.0051 u	0.005 u	0.0051 u	**0.4**	**0.3**
91-57-6	2-Methylnaphthalene	**0.560**	**0.04 j**				0.0049 u	0.0049 u	0.0049 u	0.005 u	0.0049 u	0.0049 u	0.0049 u	0.0049 u				0.0049 u	0.0049 u	0.0049 u	0.0049 u	**0.064 j**	**0.059**
83-32-9	Acenaphthene	**6.700**	**4.40**				0.01 u	0.01 u	0.01 u	0.011 u	0.01 u	0.01 u	0.01 u	0.01 u				**0.4000**	**0.2400**	**0.1900**	**0.1100**	**10**	**12**
208-96-8	Acenaphthylene[2]	**0.049 j**	0.0094 u				0.0096 u	0.0095 u	0.0094 u	0.0097 u	0.0095 u	0.0094 u	0.0096 u	0.0095 u				0.0094 u	0.0094 u	0.0094 u	0.0094 u	0.0094 u	**0.10**
120-12-7	Anthracene	**0.360**	**0.190**				0.014 u	0.014 u	0.013 u	0.014 u	0.013 u	0.013 u	0.014 u	0.014 u				0.013 u	0.013 u	0.013 u	0.013 u	**0.56**	**0.53**
56-55-3	Benz(a)anthracene	**0.052 j**	**0.016 j**				0.0031 u	0.0031 u	0.003 u	0.0031 u	0.003 u	0.003 u	0.0031 u	0.0031 u				0.003 u	0.003 u	0.003 u	**0.017 j**	0.003 u	**0.01**
50-32-8	Benzo(a)pyrene	**0.047 j**	**0.012 j**				0.0049 u	0.0049 u	0.0049 u	0.005 u	0.0049 u	0.0049 u	0.0049 u	0.0049 u				0.0049 u	0.0049 u	0.0049 u	**0.017 j b**	0.0049 u	0.0049
205-99-2	Benzo(b)fluoranthene	**0.057 j**	**0.016 j**				0.0033 u	0.0033 u	0.0033 u	0.0034 u	0.0033 u	0.0032 u	0.0033 u	0.0033 u				0.0032 u	0.0033 u	0.0033 u	**0.040 j b**	0.0033 u	**0.0083**
191-24-2	Benzo(g,h,i)perylene[2]	**0.044 j**	**0.013 j**				0.0034 u	0.0034 u	0.0034 u	0.0035 u	0.0034 u	0.0034 u	0.0034 u	0.0034 u				**0.0048 j**	0.0034 u	**0.0056 j**	**0.024 j**	0.0034 u	**0.0037**
207-08-9	Benzo(k)fluoranthene	**0.017 j**	0.0048 u				0.0048 u	0.0048 u	0.0048 u	0.0049 u	0.0048 u	0.0048 u	0.0049 u	0.0048 u				0.0048 u	0.0048 u	0.0048 u	**0.012 j b**	0.0048 u	0.0048
218-01-9	Chrysene	**0.068 j**	**0.024 j**				0.0031 u	0.003 u	0.003 u	0.0031 u	0.003 u	0.003 u	0.0031 u	0.003 u				0.003 u	0.003 u	0.003 u	**0.029 j**	0.003 u	**0.0085**
53-70-3	Dibenz(a,h)anthracene	0.0046 u	0.0046 u				0.0046 u	0.0046 u	0.0046 u	0.0047 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u				0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046
206-44-0	Fluoranthene	**0.55**	**0.43**				0.0043 u	0.0043 u	0.0043 u	0.0044 u	0.0043 u	0.0043 u	0.0044 u	0.0043 u				0.0043 u	0.0043 u	0.0043 u	**0.03 j**	**0.64**	**0.56**
86-73-7	Fluorene	**8.60**	**5.30**				0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u				0.018 u	0.018 u	0.018 u	0.02 u	**5.60**	**6.20**
193-39-5	Indeno(1,2,3-cd)pyrene	**0.024 j**	0.014 u				0.014 u	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u				0.014 u	0.014 u	0.014 u	**0.024 j**	0.014 u	0.014
79-20-9	Methyl Acetate	330 u	160 u	330 u	160 u	330 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	33 u	16
110-82-7	Cyclohexane	56 u	28 u	56 u	28 u	56 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	**8.60 j**	**10**

RSL = Regional Screening Levels
COPC = chemical of potential concern, chemical retained as a COPC if the maximum concentration exceeds the screening level
VISL = Vapor Intrusion Screening Levels, from USEPA, 2014. Vapor Intrusion Screening Level Calculator
nd = no data, chemical is not volatile as presented in the VISL Calculator
1 = screening levels are tapwater USEPA RSLs (Nov. 2015), or maximum contaminant levels for those chemicals without tapwater values.
2 = no published RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate.
3 = chemical retained as a COPC as the maximum detected concentration exceeds the RSL
4 = chemical eliminated as a COPC as the maximum detected concentration does not exceed the RSL
5 = chemical conservatively retained as a COPC because no published screening value is available
6 = retained as a COPC because it is included in the group of potentially carcinogenic PAHs and at least one in that group has exceeded its screening level

Table 3-5
SMA 4 On-Site Groundwater
Screening for Chemicals of Potential Concern
ERP Coke Facility, Birmingham, AL

CASNumber	Chemical, µg/L		MW-81 11/18/2014	MW-81 5/19/2015	MW-89 2/19/2014	MW-89 6/15/2015	Number of Samples	Number of Detections	Concentration Min		Concentration Max		Direct Contact RSL[1]	Direct Contact COPC?		VISLs Industrial	VISLs COPC?
75-01-4	Vinylchloride	u	10 u	0.400 u	0.100 u	0.100 u	67	33	0.10	u	330		0.019	**Yes**	[3]	2.5	**Yes**
67-64-1	Acetone	u	190 u	7.600 u	1.900 u	**17**	67	10	1.9000	u	13000		1400	**Yes**	[3]	9500000	No
75-09-2	Methylene chloride	u	32 u	1.300 u	**0.410 jb**	0.320 u	67	15	0.3200	u	830		11	**Yes**	[3]	2000	No
75-15-0	Carbon disulfide	u	45 u	1.800 u	**0.790 j**	0.450 u	67	1	0.4500	u	0.79		81	No	[4]	520	No
1634-04-4	Methyl tert butyl ether	u	25 u	1 u	0.25 u	0.25 u	67	3	0.2500	u	0.28		14	No	[4]	2000	No
156-60-5	trans-1,2-Dichloroethene	u	15 u	0.600 u	0.150 u	0.150 u	67	10	0.1500	u	3		36	No	[4]	nd	No
156-59-2	cis-1,2-Dichloroethene	u	15 u	0.600 u	0.150 u	0.150 u	67	31	0.1500	u	260		3.6	**Yes**	[3]	nd	No
78-93-3	2-Butanone	u	200 u	8 u	2 u	2 u	67	1	2.0000	u	3		560	No	[4]	nd	No
71-43-2	Benzene		**3000**	**13**	**4**	**0.270 j**	67	42	0.1600	u	61000		0.46	**Yes**	[3]	6.9	**Yes**
107-06-2	1,2-Dichloroethane	u	13 u	0.520 u	0.130 u	0.130 u	67	1	0.1300	u	75		0.17	**Yes**	[3]	9.8	**Yes**
79-01-6	Trichloroethene	u	16 u	0.640 u	0.160 u	0.160 u	67	3	0.1600	u	20		0.28	**Yes**	[3]	2.2	**Yes**
108-10-1	4-Methyl-2-pentanone	u	98 u	3.900 u	**1.800 j**	0.980 u	67	1	0.9800	u	1.8		630	No	[4]	nd	No
108-88-3	Toluene	u	**280**	0.680 u	**21**	**0.610 j**	67	25	0.1700	u	56000		110	**Yes**	[3]	8100	**Yes**
108-90-7	Chlorobenzene	**j**	17 u	**5.900**	0.170 u	0.170 u	67	52	0.1700	u	160000		7.8	**Yes**	[3]	170	**Yes**
100-41-4	Ethylbenzene	u	16 u	0.640 u	**4.700**	0.160 u	67	3	0.1600	u	4.7		1.5	**Yes**	[3]	15	No
	m,p-Xylenes	u	34 u	1.400 u	**23**	0.340 u	67	2	0.3400	u	690		19	**Yes**	[3]	150	**Yes**
95-47-6	o-Xylene	u	19 u	0.760 u	**12**	0.190 u	67	2	0.1900	u	12		19	No	[4]	210	No
100-42-5	Styrene	u	17 u	0.680 u	0.170 u	0.170 u	67	1	0.1700	u	2		120	No	[4]	3900	No
98-82-8	Isopropylbenzene (Cumene)		**61 j**	**73**	**0.400 j**	0.190 u	67	6	0.1900	u	65		45	**Yes**	[3]	nd	No
123-91-1	1,4-Dioxane	u	**1.80 j**	**1.80 j**	57 u	57 u	67	6	1.6000	u	3.3		0.46	**Yes**	[3]	13000	No
108-87-2	Cyclohexane, Methyl-	**j**	36 u	**11**	**16**	0.360 u	64	4	0.3600	u	16		nd	**Yes**	[5]	nd	No
	3/4-Methylphenol	u	1.400 j	0.240 u			43	22	0.2400	u	42		93	No	[4]	nd	No
120-82-1	1,2,4-Trichlorobenzene	**u**	**21 u**	**0.270 u**	**0.210 u**	**0.210 u**	67	4	0.2100	u	460		0.4	**Yes**	[3]	15	**Yes**
95-50-1	1,2-Dichlorobenzene	u	15 u	0.220 u	0.150 u	0.150 u	67	2	0.1500	u	4		30	No	[4]	1100	No
541-73-1	1,3-Dichlorobenzene	**u**	**0.290 u**	**0.520 u**			43	8	0.1300	u	8.4		nd	**Yes**	[5]	nd	No
106-46-7	1,4-Dichlorobenzene	u	0.310 u	0.640 u			43	13	0.1600	u	560		0.48	**Yes**	[3]	11	**Yes**
105-67-9	2,4-Dimethylphenol	u	0.550 u	0.550 u			43	4	0.5500	u	1.10		36	No	[4]	nd	No
95-57-8	2-Chlorophenol	u	1.900 u	1.900 u			43	5	1.9000	u	39		9.1	**Yes**	[3]	nd	No
95-48-7	2-Methylphenol	u	0.940 u	0.930 u			43	6	0.9300	u	30		93	No	[4]	nd	No
98-86-2	Acetophenone	u	**0.34 j**	0.23 u			43	6	0.2300	u	4.20		nd	**Yes**	[5]	nd	No
100-51-6	Benzyl alcohol	u	0.22 u	0.22 u			43	3	0.2200	u	1.60		200	No	[4]	nd	No
86-74-8	Carbazole	u	0.41 u	0.41 u			43	5	0.4100	u	1.40		nd	**Yes**	[5]	nd	No
132-64-9	Dibenzofuran	u	0.28 u	0.28 u			43	8	0.2700	u	3.70		0.79	**Yes**	[3]	nd	No
131-11-3	Dimethyl phthalate	u	0.20 u	0.20 u			43	2	0.2000	u	0.53		nd	**Yes**	[5]	nd	No
87-86-5	Pentachlorophenol	u	19 u	19 u			43	1	19.000	u	21		0.041	**Yes**	[3]	nd	No
108-95-2	Phenol	**j**	**29**	1.9 u			43	16	1.9000	u	270		580	No	[4]	nd	No
129-00-0	Pyrene		**0.35**	**0.27**			43	23	0.0076	u	1.30		12	No	[4]	nd	No
91-20-3	Naphthalene		**2.2**	**0.4**			39	15	0.0049	u	30.0		0.17	**Yes**	[3]	20	**Yes**
91-57-6	2-Methylnaphthalene	**j**	**0.760**	**0.140**			43	21	0.0049	u	1.40		3.6	No	[4]	nd	No
83-32-9	Acenaphthene		**14**	**12**			43	29	0.0094	u	14.0		53	No	[4]	nd	No
208-96-8	Acenaphthylene[2]		0.0095 u	0.0095 u			43	16	0.0094	u	0.160		12	No	[4]	nd	No
120-12-7	Anthracene		**0.64**	**0.37**			43	17	0.0030	u	0.640		180	No	[4]	nd	No
56-55-3	Benz(a)anthracene	**j**	0.0031 u	**0.02 j**			43	13	0.0030	u	0.530		0.012	**Yes**	[3]	nd	No
50-32-8	Benzo(a)pyrene	u	0.0049 u	**0.014 j b**			43	12	0.0033	u	0.50		0.003	**Yes**	[3]	nd	No
205-99-2	Benzo(b)fluoranthene	**j**	0.0033 u	**0.022 j b**			43	13	0.0032	u	0.650		0.034	**Yes**	[3]	nd	No
191-24-2	Benzo(g,h,i)perylene[2]	**j**	0.0034 u	**0.015 j**			43	15	0.0034	u	0.510		12	No	[4]	nd	No
207-08-9	Benzo(k)fluoranthene	u	0.0048 u	0.0048 u			43	10	0.0030	u	0.180		0.34	No	[4]	nd	No
218-01-9	Chrysene	**j**	0.003 u	**0.026 j**			43	11	0.0030	u	1.0		3.4	**Yes**	[6]	nd	No
53-70-3	Dibenz(a,h)anthracene	u	0.0046 u	0.0046 u			43	6	0.0043	u	0.20		0.003	**Yes**	[3]	nd	No
206-44-0	Fluoranthene		**0.76**	**0.560**			43	24	0.0043	u	2.0		80	No	[4]	nd	No
86-73-7	Fluorene		**6.60**	**4.5**			43	18	0.0140	u	8.60		29	No	[4]	nd	No
193-39-5	Indeno(1,2,3-cd)pyrene	u	0.014 u	**0.015 j**			49	6	0.0140	u	0.32		0.034	**Yes**	[3]	nd	No
79-20-9	Methyl Acetate	u	160 u	6.60 u	1.600 u	1.600 u	59	1	0.2800	u	1		2000	No	[4]	nd	No
110-82-7	Cyclohexane	**j**	28 u	**12**	**27**	**0.330 j**	49	5	0.2800	u	9		1300	No	[4]	430	No

RSL = Regional Screening Levels
COPC = chemical of potential concern, chemical retained as a COPC if the maximum concentration exceeds the screening level
VISL = Vapor Intrusion Screening Levels, from USEPA, 2014. Vapor Intrusion Screening Level Calculator
nd = no data, chemical is not volatile as presented in the VISL Calculator
1 = screening levels are tapwater USEPA RSLs (Nov. 2015), or maximum contaminant levels for those chemicals without tapwater values.
2 = no published RSL exists for this chemical; hence, the RSL for pyrene is used as a surrogate.
3 = chemical retained as a COPC as the maximum detected concentration exceeds the RSL
4 = chemical eliminated as a COPC as the maximum detected concentration does not exceed the RSL
5 = chemical conservatively retained as a COPC because no published screening value is available
6 = retained as a COPC because it is included in the group of potentially carcinogenic PAHs and at least one in that group has exceeded its screening level

Table 3-6
SMA 4 - Summary of Human Exposure Assumptions[a]
ERP Coke Facility, Birmingham, Alabama

Exposure Pathway	Parameter	Industrial Worker (Adult)	Construction Worker (Adult)	Adolescent Trespasser	Adult Resident	Child Resident	Parameter Units
General	Body weight (BW)	80	80	47	80	15	kg
	Exposure frequency (EF)	250	250	12	350	350	days/year
	Exposure duration (ED)	25	1	10	26	6	year
	Exposure time (ET)	8	8	1	24	24	hour/day
	Averaging time - Cancer[b] (AT_C)	25,550	25,550	25,550	25,550	25,550	days
	Averaging time - Noncancer[c] (AT_{NC})	9,125	365	3,650	9,490	2,190	days
Exposure Times	Groundwater, dermal, while showering[d]	0.33	na	na	na	na	hour/event
	Groundwater, inhalation while showering[d]	0.25	na	na	na	na	hour/event
	Groundwater, dermal, while trenching[d]	na	2	na	na	na	hours/event
	Groundwater, inhalation while trenching[d]	na	2	na	na	na	hours/event
Ingestion	Soil intake rate (IR_S)[e]	100	330	100	100	200	mg/day
	Drinking water (IR_W)	1	na	na	na	na	L/day
Inhalation	Particle Emission Factor (PEF)[e]	5.70E+09	5.70E+09	5.70E+09	5.70E+09	5.70E+09	m^3/kg
Dermal Absorption	Skin surface area available for contact (SSA)[f] (includes: face, forearms, and hands)	3,470	3,470	5,595	5,700	2,690	cm^2
	Skin surface area during showering	20,900	na	na	na	na	cm^2
	Soil to skin adherence factor (SAF)[e]	0.12	0.12	0.2	0.07	0.2	mg/cm^2

[a]Unless otherwise noted, all exposure parameters are obtained from USEPA, 2014 (OSWER Directive 9200.1-120).
[b]Averaging time of exposure for carcinogenic effects is calculated as follows: 70-year lifetime exposure (70 years x 365 days/year = 25,550 days)
[c]Averaging time for noncarcinogenic effects is calculated as follows: ED years x 365 days/year
[d]Professional judgement
[e]From: USEPA, 2002. *Supplemental Guidance for Developing Soil Screening Levels.*
[f]From: USEPA, 2004. *RAGS Part E, Dermal Expsoure Guidance* .
na = not applicable for this receptor

Table 3-7
SMA 4 - Surface Soil, 0-1 ft
Chemicals of Potential Concern Exposure Point Concentrations
ERP Coke Facility, Birmingham, Alabama

Chemical Name	Maximum Concentration mg/kg	95% UCL mg/kg	EPC mg/kg
COPCs for Workers			
Carbazole	0.17	0.109	0.11
Benz(a)anthracene	6.6	4.513	4.513
Benzo(a)pyrene	7.7	5.071	5.071
Benzo(b)fluoranthene	13	8.478	8.478
Chrysene	9.4	7.166	7.166
Dibenz(a,h)anthracene	2.1	1.469	1.469
Indeno(1,2,3-cd)pyrene	6.3	4.195	4.195
Arsenic	26	19.89	19.89
Chromium	68	50.34	50.34
COPCs for Trespassers			
Carbazole	0.17	0.109	0.11
Benz(a)anthracene	6.6	4.513	4.513
Benzo(a)pyrene	7.7	5.071	5.071
Benzo(b)fluoranthene	13	8.478	8.478
Chrysene	9.4	7.166	7.166
Dibenz(a,h)anthracene	2.1	1.469	1.469
Indeno(1,2,3-cd)pyrene	6.3	4.195	4.195
Naphthalene	5.8	4.43	4.43
Aluminum	49000	25431	25431
Arsenic	26	19.89	19.89
Chromium	68	50.34	50.34
Cobalt	18	12.9	12.9
Manganese	2500	1427	1427
Vanadium	69	44.96	44.96

UCL = upper confidence limit, as calculated by ProUCL V.5.0.0 (USEPA, 2015)
EPC = exposure point concentration; the lesser of the maximum concentration or the UCL

Table 3-8
SMA 4 - Subsurface Soil, 2 - 15 ft
Chemicals of Potential Concern Exposure Point Concentrations
ERP Coke Facility, Birmingham, Alabama

Chemical Name	Maximum Concentration mg/kg	95% UCL mg/kg	EPC mg/kg
1,1,2-Trichloroethane	0.81	nc	0.81
Benzene	1400	87.31	87.31
Chlorobenzene	6100	270.4	270.4
Ethylbenzene	460	26.11	26.11
Toluene	56000	2744	2744
Vinyl chloride	3.3	0.116	0.116
Xylenes	2500	198.5	198.5
Benzo(a)anthracene	110	5.42	5.42
Benzo(a)pyrene	98	4.536	4.536
Benzo(b)fluoranthene	130	6.275	6.275
Benzo(k)fluoranthene	45	1.462	1.462
Carbazole	44	1.952	1.952
Chrysene	100	4.904	4.904
Dibenzo(a,h)anthracene	14	0.479	0.479
Indeno(1,2,3-cd)pyrene	40	1.38	1.38
Naphthalene	1700	80.48	80.48
Arsenic	18	9.869	9.869
Chromium	120	32.7	32.7

UCL = upper confidence limit, as calculated by ProUCL
as calculated by ProUCL V.5.0.0 (USEPA, 2013)
EPC = exposure point concentration, the lesser of the maximum concentration or the UCL

Table 3-9
SMA 4 - Mineral Wool Pile
Chemicals of Potential Concern Exposure Point Concentrations
ERP Coke Facility, Birmingham, Alabama

Chemical Name	Maximum Concentration mg/kg	95% UCL mg/kg	EPC mg/kg
Benzo(a)pyrene	0.18	0.104	0.104
Benzo(a)anthracene	0.2	0.101	0.101
Benzo(b)fluoranthene	0.22	0.0812	0.081
Chrysene	0.23	0.0878	0.0878
Dibenz(a,h)anthracene	0.065	nc	0.065
Indeno(1,2,3-cd)pyrene	0.08	0.0345	0.0345
Carbazole	0.019	nc	0.019
Arsenic	4.2	2.418	2.418
Chromium	47	34.55	34.55

UCL = upper confidence limit, as calculated by ProUCL V.5.0.0 (USEPA, 2015)

EPC = exposure point concentration; the lesser of the maximum concentration or the UCL

nc = not calculated, too few detections to calculate a UCL.

Table 3-10
SMA 4 On-Site Groundwater - Exposure Point Concentrations
ERP Coke Facility, Birmingham, AL

	Concentration (µg/L)		EPC	
Chemical ug/L	**Maximum**	**UCL**	**µg/L**	**mg/L**
Vinylchloride	330	79.22	79.22	0.07922
Acetone	13000	1499	1499	1.499
Methylene chloride	830	87.53	87.53	0.08753
cis-1,2-Dichloroethene	260	54.63	54.63	0.05463
Benzene	61000	18004	18004	18.004
1,2-Dichloroethane	75	nc	75	0.075
Trichloroethene	20	1.242	1.242	0.001242
Toluene	56000	14252	14252	14.252
Chlorobenzene	160000	44429	44429	44.429
Ethylbenzene	4.7	0.4399	0.4399	0.0004399
m,p-Xylenes	680	34.86	34.86	0.03486
Isopropylbenzene	73	8.062	8.062	0.008062
1,4-Dioxane	3.3	1.831	1.831	0.001831
Cyclohexane, Methyl-	16	1.724	1.724	0.001724
1,2,4-Trichlorobenzene	460	32.65	32.65	0.03265
1,3-Dichlorobenzene	8.4	2.114	2.114	0.002114
1,4-Dichlorobenzene	560	229.2	229.2	0.2292
2-Chlorophenol	39	6.233	6.233	0.006233
Acetophenone	4.2	0.748	0.748	0.000748
Carbazole	1.4	0.567	0.567	0.000567
Dibenzofuran	3.7	0.735	0.735	0.000735
Dimethyl phthalate	0.53	0.235	0.235	0.000235
Pentachlorophenol	21.0	nc	21.0	0.021
Naphthalene	30.0	7.623	7.623	0.007623
Benz(a)anthracene	0.53	0.0876	0.0876	0.0000876
Benzo(a)pyrene	0.50	0.0469	0.0469	0.0000469
Benzo(b)fluoranthene	0.65	0.0621	0.0621	0.0000621
Chrysene	1	0.145	0.145	0.0001450
Dibenz(a,h)anthracene	0.20	0.0215	0.0215	0.0000215
Indeno(1,2,3-cd)pyrene	0.32	0.0421	0.0421	0.0000421

UCL = upper confidence level, as calculated using USEPA's ProUCL ver. 5.0.0 (2013)
EPC = exposure point concentration
nc = not calculated, too few detections

Table 3-11
SMA 4 - Carcinogenic Oral and Dermal Toxicity Values
ERP Coke Facility, Birmingham, Alabama

Chemicals of Potential Concern (COPCs)	Oral SF $(mg/kg\text{-}day)^{-1}$	Oral Absorption Efficiency for Dermal unitless	Dermal SF (mg/kg-day)	Weight of Evidence/ Cancer Guildeline Description	Affected Organ/System	Oral SF Source
Acetone	--	1	--	--	--	--
Acetophenone	--	1	--	D	--	IRIS
Aluminum	--	1	--	--	--	--
Arsenic	1.5	1	1.5	A	skin	IRIS
Benzene	0.055	1	0.055	A	hematological	IRIS
Benzo(a)anthracene	0.73	1	0.73	B2	gastrointestinal	IRIS
Benzo(a)pyrene	7.3	1	7.3	B2	gastrointestinal	IRIS
Benzo(b)fluoranthene	0.73	1	0.73	B2	gastrointestinal	IRIS
Benzo(k)fluoranthene	0.073	1	0.073	B2	gastrointestinal	IRIS
Carbazole	--	--	--	--	--	--
Chlorobenzene	--	--	--	D	--	IRIS
2-Chlorophenol	--	--	--	--	--	--
Chromium (VI)	0.5	0.025	20	A	respiratory	IRIS
Chrysene	0.0073	1	0.0073	B2	gastrointestinal	IRIS
Cobalt	--	--	--	--	--	--
Cyclohexane, methyl	--	--	--	--	--	--
Dibenzo(a,h)anthracene	7.3	1	7.3	B2	gastrointestinal	IRIS
Dibenzofuran	--	1	--	--	--	--
1,3-Dichlorobenzene	--	--	--	D	--	--
1,4-Dichlorobenzene	0.0054	1	0.0054	2B	--	Cal/EPA
1,2-Dichloroethane	0.091	1	0.091	--	--	--
cis-1,2-Dichloroethene	--	1	--	--	--	--
Dimethyl phthalate	--	--	--	--	--	--
1,4-Dioxane	0.1	1	0.1	likely to be carcinogenic	liver	IRIS
Ethylbenzene	0.011	1	0.011	D	--	CalEPA/IRIS
Indeno(1,2,3-cd)pyrene	0.73	1	0.73	B2	gastrointestinal	IRIS
Isopropylbenzene (Cumene)	--	1	--	D	--	IRIS
Manganese	--	0.04	--	D	--	IRIS
Methylene Chloride	0.002	1	0.002	likely to be carcinogenic	liver	IRIS
Naphthalene	--	1	--	C	--	IRIS
Pentachlorophenol	0.4	1	0.4	likely to be carcinogenic	liver	IRIS
Toluene	--	1	--	--	--	--
1,2,4-Trichlorobenzene	0.029	1	0.029	D	--	PPRTV
1,1,2-Trichloroethane	0.057	1	0.057	C	liver	IRIS
Trichloroethene	0.046	1	0.046	carcinogenic to humans	hematological, liver	IRIS
Vanadium	--	0.026	--	--	--	IRIS
Vinyl chloride	0.72	1	0.72	A	liver	IRIS
Xylenes, Total	--	1	--	--	--	--

IRIS = Integrated Risk Information System; accessed at http://www.epa.gov/iris
CalEPA = California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA); http://www.oehha.ca.gov/tcdb/
PPRTV = Provisional Peer Review Toxicity Values for Superfund; http://www.hhpprtv.ornl.gov/index.html
Carcinogenic Categories:
A = Carcinogenic to humans, adequate human data
B = Probably carcinogenic to humans, sufficient evidence from animal data
C = Possibly carcinogenic to humans, limited animal evidence
D = Not classifiable as to human carcinogenicity

Table 3-12
SMA 4 - Carcinogenic Inhalation Toxicity Values
ERP Coke Facility, Birmingham, Alabama

Chemicals of Potential Concern (COPCs)	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Weight of Evidence/ Cancer Guildeline Description	Unit Risk Source
Acetone	--	--	--
Acetophenone	--	--	--
Aluminum	--	--	--
Arsenic	4.30E-03	A	IRIS
Benzene	7.80E-06	A	IRIS
Benzo(a)anthracene	1.10E-04	B2/2A	CalEPA
Benzo(a)pyrene	1.10E-03	B2/2A	CalEPA
Benzo(b)fluoranthene	1.10E-04	B2/2B	CalEPA
Benzo(k)fluoranthene	1.10E-04	B2/2B	CalEPA
Carbazole	--	--	--
Chlorobenzene	--	--	--
2-Chlorophenol	--	--	--
Chromium (IV)	8.40E-02	A	USEPA-RSLs
Chrysene	1.10E-05	B2/3	CalEPA
Cobalt	9.00E-03	likely to be carcinogenic, alveolar/bronchiolar	PPTRV
Cyclohexane, methyl	--	--	--
Dibenzo(a,h)anthracene	1.20E-03	B2	CalEPA
Dibenzofuran	--	--	--
1,3-Dichlorobenzene	--	--	--
1,4-Dichlorobenzene	1.10E-05	central nervous system	CalEPA
1,2-Dichloroethane	2.60E-05	--	--
cis-1,2-Dichloroethene	--	--	--
Dimethyl phthalate	--	--	--
1,4-Dioxane	5.00E-06	nasal, liver, kidney, peritoneal, mammary	IRIS
Ethylbenzene	2.50E-06	D	CalEPA/IRIS
Indeno(1,2,3-cd)pyrene	1.10E-04	B2	CalEPA
Isopropylbenzene (Cumene)	--	D	IRIS
Manganese	--	D	IRIS
Methylene Chloride	1.00E-08	likely to be carcinogenic	IRIS
Naphthalene	3.40E-05	C	CalEPA/IRIS
Pentachlorophenol	5.10E-06	likely to be carcinogenic	IRIS
Toluene	--	--	--
1,2,4-Trichlorobenzene	--	--	--
1,1,2-Trichloroethane	1.60E-05	--	--
Trichloroethene	4.10E-06	2A	IRIS
Vanadium	--	--	IRIS
Vinyl chloride	4.40E-06	A	IRIS
Xylenes, total	--	--	--

IRIS = Integrated Risk Information System; accessed at http://www.epa.gov/iris
CalEPA = California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA); http://www.oehha.ca.gov/tcdb/
PPRTV = Provisional Peer Review Toxicity Values for Superfund; http://www.hhpprtv.ornl.gov/index.html
USEPA RSLs = US Environmental Protection Agency Regional Screening Levels; http://www.epa.gov/region9/superfund/prg/index.html

Carcinogenic Categories:
A = Carcinogenic to humans, adequate human data
B = Probably carcinogenic to humans, sufficient evidence from animal data
C = Possibly carcinogenic to humans, limited animal evidence
D = Not classifiable as to human carcinogenicity

Table 3-13
SMA 4 - Noncarcinogenic Oral and Dermal Toxicity Values
ERP Coke Facility, Birmingham, Alabama

Chemicals of Potential Concern (COPCSs)	Oral Reference Dose (RfD) (mg/kg-day)	Gastrointestinal Absorption Efficiency (%)	Default Dermal RfD mg/kg-day	Primary Target Organ(s)	Uncertainty/ Modifying Factor	Source
Acetone	9.00E-01	1	9.00E-01	kidney	1000	IRIS
Acetophenone	1.00E-01	1	1.00E-01	general toxicity	3000	IRIS
Aluminum	1.00E+00	1	1.00E+00	neurotoxicity	100	PPRTV
Arsenic	3.00E-04	1	3.00E-04	skin	3	IRIS
Benzene	4.00E-03	1	4.00E-03	lymphocytes	300	IRIS
Benzo(a)anthracene	--	1	--	--	--	--
Benzo(a)pyrene	--	1	--	--	--	--
Benzo(b)fluoranthene	--	1	--	--	--	--
Benzo(k)fluoranthene	--	1	--	--	--	--
Carbazole	--	--	--	--	--	--
Chlorobenzene	2.00E-02	1	2.00E-02	liver	1000	IRIS
2-Chlorophenol	5.00E-03	1	5.00E-03	reproductive effects	1000	IRIS
Chromium	3.00E-03	0.025	1.20E-01	respiratory	900	IRIS
Chrysene	--	1	--	--	--	--
Cobalt	3.00E-04	1	3.00E-04	thyroid	300	PPRTV
Cyclohexane, methyl	--	--	--	--	--	--
Dibenzo(a,h)anthracene	--	1	--	--	--	--
Dibenzofuran	1.00E-03	1	1.00E-03	hepatotoxicity	10000	PPRTV
1,3-Dichlorobenzene	--	--	--	--	na	--
1,4-Dichlorobenzene	7.00E-02	1	7.00E-02	liver	300	IRIS
1,2-Dichloroethane	6.00E-03	1	6.00E-03	kidney	--	PPRTV
cis-1,2-Dichloroethene	2.00E-03	1	2.00E-03	kidney	3,000	IRIS
Dimethyl phthalate	--	--	--	--	--	--
1,4-Dioxane	3.00E-02	1	3.00E-02	liver, kidney	300	IRIS
Ethylbenzene	1.00E-01	1	1.00E-01	liver/kidney	1000	IRIS
Indeno(1,2,3-cd)pyrene	--	1	--	na	--	--
Isopropylbenzene (Cumene)	1.00E-01	1	1.00E-01	kidney	1000	IRIS
Manganese	2.40E-02	0.04	6.00E-01	nervous system	1	IRIS
Methylene Chloride	6.00E-03	1	6.00E-03	liver	30	IRIS
Naphthalene	2.00E-02	1	2.00E-02	body weight	3,000	IRIS
Pentachlorophenol	5.00E-03	1	5.00E-03	liver	300	IRIS
Toluene	8.00E-02	1	8.00E-02	kidney	3,000	IRIS
1,2,4-Trichlorobenzene	1.00E-02	1	1.00E-02	endocrine system	1000	IRIS
1,1,2-Trichloroethane	4.00E-03	1	4.00E-03	immune system, hematologic	1000	IRIS
Trichloroethene	5.00E-04	1	5.00E-04	hematologic, liver, kidney	100	IRIS
Vanadium	5.00E-03	0.026	1.92E-01	skin	100	IRIS
Vinyl chloride	3.00E-03	1	3.00E-03	liver	30	IRIS
Xylenes, Total	2.00E-01	1	2.00E-01	body weight	1,000	IRIS

IRIS = Integrated Risk Information System; accessed at http://www.epa.gov/iris
PPRTV = Provisional Peer Review Toxicity Values for Superfund; http://www.hhpprtv.ornl.gov/index.html

Table 3-14
SMA 4 - Noncarcinogenic Inhalation Values
ERP Coke Facility, Birmingham, Alabama

Chemicals of Potential Concern (COPCSs)	Inhalation Reference Concentration RfC (mg/m^3)	RfC ($\mu g/m^3$)	Primary Target Organ(s)	Uncertainty/ Modifying Factor	Source
Acetone	3.10E+01	3.10E+04	kidney	--	ATSDR
Acetophenone	--	--	--	--	--
Aluminum	5.00E-03	5.00E+00	neurotoxicity	300	PPRTV
Arsenic	1.50E-05	1.50E-02	cardiovascular	--	CalEPA
Benzene	3.00E-02	3.00E+01	immune system	300	IRIS
Benzo(a)anthracene	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--
Benzo(k)fluoranthene	--	--	--	--	--
Carbazole	--	--	--	--	--
Chlorobenzene	5.00E-02	5.00E+01	liver, kidney	1000	PPRTV
2-Chlorophenol	--	--	--	--	--
Chromium	1.00E-04	1.00E-01	--	90	IRIS
Cobalt	--	--	respiratory tract	300	PPRTV
Chrysene	6.00E-06	6.00E-03	--	--	--
Methylcyclohexane	--	--	--	--	--
Dibenzo(a,h)anthracene	--	--	--	--	--
Dibenzofuran	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--
1,4-Dichlorobenzene	8.00E-01	8.00E+02	liver	100	IRIS
1,2-Dichloroethane	7.00E-03	7.00E+00	--	--	--
cis-1,2-Dichloroethene	3.10E+01	3.10E+04	nervous system	--	PPRTV
Dimethyl phthalate	--	--	--	--	--
1,4-Dioxane	3.00E-02	3.00E+01	nervous system, respiratory	1000	IRIS
Ethylbenzene	1.00E+00	1.00E+03	nervous system	300	IRIS
Indeno(1,2,3-cd)pyrene	--	--	--	--	--
Isopropylbenzene (Cumene)	4.00E-01	4.00E+02	kidney, endocrine	1000	IRIS
Manganese	5.00E-05	5.00E-02	nervous system	1000	IRIS
Methylene Chloride	6.00E-01	6.00E+02	liver	30	IRIS
Naphthalene	3.00E-03	3.00E+00	nasal	3000	IRIS
Pentachlorophenol	3.10E+01	3.10E+04	--	--	--
Toluene	5.00E+00	5.00E+03	nervous system	10	IRIS
1,2,4-Trichlorobenzene	2.00E-03	2.00E+00	kidney	3000	PPRTV
1,1,2-Trichloroethane	2.00E-04	2.00E-01	--	--	CalEPA

Table 3-14
SMA 4 - Noncarcinogenic Inhalation Values
ERP Coke Facility, Birmingham, Alabama

Chemicals of Potential Concern (COPCSs)	Inhalation Reference Concentration RfC (mg/m^3)	RfC ($\mu g/m^3$)	Primary Target Organ(s)	Uncertainty/ Modifying Factor	Source
Trichloroethene	2.00E-03	2.00E+00	thymus	100	IRIS
Vanadium	1.00E-04	1.00E-01	skin	100	IRIS
Vinyl chloride	1.00E-01	1.00E+02	liver	30	IRIS
Xylenes, Total	1.00E-01	1.00E+02	nervous system	90	IRIS

ATSDR = Agency for Toxic Substances and Disease Registry; http://www.atsdr.cdc.gov/mrls/mrllist.asp
PPRTV = Provisional Peer Review Toxicity Values for Superfund; http://www.hhpprtv.ornl.gov/index.html
CalEPA = California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA); http://www.oehha.ca.gov/tcdb/
IRIS = Integrated Risk Information System; accessed at http://www.epa.gov/iris

Table 3-15
SMA 4 - Risk Characterization Summary
Receptors Exposed to Surface Soil, 0-1 ft
ERP Coke Facility, Birmingham, Alabama

	Industrial/Commercial Worker		Construction Worker		Adolescent Trespasser	
Chemical	**ELCR**	**HQ**	**ELCR**	**HQ**	**ELCR**	**HQ**
Benz(a)anthracene	**1.6E-06**	na	1.9E-08	na	2.4E-07	na
Benzo(a)pyrene	**1.7E-05**	na	2.2E-07	na	**2.7E-06**	na
Benzo(b)fluoranthene	**2.9E-06**	na	3.6E-08	na	4.6E-07	na
Chrysene	2.5E-08	na	3.1E-10	na	3.9E-09	na
Dibenz(a,h)anthracene	**5.1E-06**	na	6.2E-08	na	7.9E-07	na
Indeno(1,2,3-cd)pyrene	**1.4E-06**	na	1.8E-08	na	2.3E-07	na
Naphthalene	--	--	--	--	1.9E-10	5.1E-05
Aluminum	--	--	--	--	na	1.8E-03
Arsenic	**1.0E-05**	6.4E-02	1.7E-07	2.8E-02	4.0E-07	6.2E-03
Chromium	**7.8E-06**	1.4E-02	1.5E-07	6.8E-03	7.6E-07	1.2E-03
Cobalt	--	--	--	--	4.0E-12	3.0E-03
Manganese	--	--	--	--	na	7.2E-04
Vanadium	--	--	--	--	na	6.3E-04
Totals	**4.6E-05**	7.8E-02	6.7E-07	3.5E-02	**5.6E-06**	1.4E-02

ELCR = Excess Lifetime Cancer Risk
HQ = Hazard Quotient
na = not applicable; toxicity factors are not available for these chemicals
"--" = chemical not a chemical of potential concern for this receptor
BOLD font depicts chemicals exhibiting ELCRs greater than 1E-06 and HQs greater than 0.1.

Table 3-16
SMA 4, Risk Characterization Summary
Receptors Exposed to Subsurface Soil, 2-15 ft
ERP Coke Facility, Birmingham, Alabama

	Industrial Worker		Construction Worker	
Chemical	**ELCR**	**HQ**	**ELCR**	**HQ**
1,1,2-Trichloroethane	2.2E-09	1.7E-03	5.7E-09	8.4E-02
Benzene	2.3E-07	2.8E-03	6.0E-07	**1.8E-01**
Chlorobenzene	na	2.7E-03	na	**1.6E-01**
Ethylbenzene	1.4E-08	1.8E-05	3.6E-08	1.4E-03
Toluene	na	9.7E-04	na	**1.2E-01**
Vinyl chloride	1.1E-09	4.3E-06	4.5E-09	2.9E-04
Xylenes	na	1.0E-03	na	5.4E-02
Benzo(a)anthracene	3.7E-08	na	1.9E-07	na
Benzo(a)pyrene	3.1E-07	na	**1.6E-06**	na
Benzo(b)fluoranthene	4.3E-08	na	2.2E-07	na
Benzo(k)fluoranthene	1.0E-09	na	5.0E-09	na
Carbazole	na	na	na	na
Chrysene	3.5E-10	na	1.7E-09	na
Dibenzo(a,h)anthracene	3.3E-08	na	1.6E-07	na
Indeno(1,2,3-cd)pyrene	9.5E-09	na	4.7E-08	na
Naphthalene	6.3E-08	1.8E-03	1.3E-07	9.9E-02
Arsenic	1.0E-07	6.3E-04	6.2E-07	9.6E-02
Chromium	1.0E-07	1.9E-04	6.6E-07	3.1E-02
Totals	9.5E-07	1.2E-02	**4.2E-06**	**8.3E-01**

ELCR = Excess Lifetime Cancer Risk
HQ = Hazard Quotient
BOLD font depicts chemicals exhibiting HQs greater than 1.0.
na = not applicable; toxicity factors are not available for these chemicals

Table 3-17
SMA 4 - Risk Characterization Summary
Receptors Exposed to the Mineral Wool Pile
ERP Coke Facility, Birmingham, Alabama

	Industrial Worker		Adult Residents		Child Residents	
Chemical	**ELCR**	**HQ**	**ELCR**	**HQ**	**ELCR**	**HQ**
Benzo(a)pyrene	5.2E-08	na	8.9E-10	na	1.1E-09	na
Benzo(a)anthracene	5.1E-09	na	3.1E-10	na	3.8E-10	na
Benzo(b)fluoranthene	4.0E-09	na	7.2E-11	na	8.8E-11	na
Chrysene	4.8E-11	na	2.0E-11	na	2.5E-11	na
Dibenz(a,h)anthracene	3.2E-08	na	3.0E-10	na	3.8E-10	na
Indeno(1,2,3-cd)pyrene	1.7E-09	na	1.5E-11	na	1.9E-11	na
Carbazole	na	na	na	na	na	na
Arsenic	1.8E-07	1.1E-03	6.5E-10	2.7E-05	1.5E-10	5.5E-05
Chromium	8.0E-07	1.4E-03	1.8E-07	5.9E-05	2.2E-07	1.2E-04
Totals	1.1E-06	2.6E-03	1.9E-07	8.6E-05	2.3E-07	1.7E-04

ELCR = Excess Lifetime Cancer Risk
HQ = Hazard Quotient
na = not applicable; toxicity factors are not available for these chemicals

Table 3-18
SMA 4 - Risk Characterization Summary
Receptors Exposed to Chemicals in On-Site Groundwater
ERP Coke Facility, Birmingham, Alabama

	Industrial/Commercial Worker		Construction Worker	
Chemical	**ELCR**	**HQ**	**ELCR**	**HQ**
Vinylchloride	**2.1E-04**	**3.8E-01**	**1.7E-06**	**2.5E-01**
Acetone	na	2.2E-02	na	5.8E-03
Methylene chloride	6.1E-07	**1.6E-01**	3.4E-09	3.9E-02
cis-1,2-Dichloroethene	na	**2.7E-01**	na	8.9E-03
Benzene	**1.2E-02**	**1.4E+02**	**5.5E-04**	**1.6E+02**
1,2-Dichloroethane	**1.4E-04**	**1.9E+00**	**6.4E-06**	**2.4E+00**
Trichloroethene	5.1E-07	**1.3E-01**	1.5E-08	**1.3E-01**
Toluene	na	**2.7E+00**	na	**8.7E-01**
Chlorobenzene	na	**1.7E+02**	na	**2.0E+02**
Ethylbenzene	9.1E-08	1.4E-04	3.7E-09	1.1E-04
m,p-Xylenes	na	6.0E-02	na	8.1E-02
Isopropylbenzene	na	na	na	na
1,4-Dioxane	**1.1E-06**	1.1E-02	2.5E-09	1.2E-03
Cyclohexane, Methyl-	na	na	na	na
1,2,4-Trichlorobenzene	**8.4E-06**	**2.8E+00**	2.8E-08	**2.8E+00**
1,3-Dichlorobenzene	na	na	na	na
1,4-Dichlorobenzene	**1.6E-04**	**1.0E-01**	**7.0E-06**	6.0E-02
2-Chlorophenol	na	1.2E-02	na	3.0E-04
Acetophenone	na	6.8E-05	na	8.3E-07
Carbazole	na	na	na	na
Dibenzofuran	na	2.1E-02	na	2.1E-03
Dimethyl phthalate	na	na	na	na
Pentachlorophenol	**4.1E-04**	**5.7E-01**	4.5E-07	1.6E-02
Naphthalene	**1.5E-05**	**4.2E-01**	7.0E-07	**4.8E-01**
Benz(a)anthracene	**1.1E-05**	na	1.5E-08	na
Benzo(a)pyrene	**8.6E-05**	na	1.0E-07	na
Benzo(b)fluoranthene	**6.6E-06**	na	8.0E-09	na
Chrysene	1.9E-07	na	2.7E-10	na
Dibenz(a,h)anthracene	**6.3E-05**	na	6.3E-08	na
Indeno(1,2,3-cd)pyrene	**1.6E-05**	na	1.6E-08	na
Totals	**1.3E-02**	**3.3E+02**	**5.6E-04**	**3.7E+02**

ELCR = Excess Lifetime Cancer Risk
HQ = Hazard Quotient
na = not applicable; toxicity factors are not available for these chemicals
BOLD represents ELCRs greater than 1E-05 and noncancer HQs greater than 1.0.

Table 3-19
SMA 4 On-Site Groundwater
Noncancer Risks (Hazards) Segregated by Target Organ and System
ERP Coke Facility, Birmingham, AL

Target Organ	Chemical	Industrial/Commercial Worker HQ	Construction Worker HQ
Liver	Chlorobenzene	1.7E+02	2.0E+02
	1,4-Dichlorobenzene	1.0E-01	--
	Methylene chloride	1.6E-01	--
	Pentachlorophenol	5.7E-01	--
	Vinyl chloride	3.8E-01	2.50E-01
	Trichloroethene	1.30E-01	1.30E-01
	Total Liver	1.8E+02	2.0E+02
Kidney	Chlorobenzene	1.7E+02	2.0E+02
	1,2-Dichloroethane	1.9E+00	2.40E+00
	cis-1,2-Dichloroethene	2.7E-01	--
	1,2,4-Trichlorobenzene	2.8E+00	2.8E+00
	Toluene	2.7E+00	8.7E-01
	Trichloroethene	1.30E-01	1.30E-01
	Total Kidney	1.8E+02	2.1E+02
Lyphocytes	Benzene	1.4E+02	1.6E+02
Nervous System	cis-1,2-Dichloroethene	2.7E-01	--
	Methylene chloride	2.70E-01	--
	Toluene	2.7E+00	8.7E-01
	Total Nervous System	3.2E+00	8.7E-01
Immune System	Benzene	1.4E+02	1.6E+02
Endocrine System	1,2,4-Trichlorobenzene	2.8E+00	2.8E+00
Thymus	Trichloroethene	1.30E-01	1.30E-01
Nasal	Naphthalene	4.2E-01	4.8E-01
Body weight	Naphthalene	4.2E-01	4.8E-01
	Vinyl chloride	3.8E-01	2.50E-01
	Total Body Weight	8.0E-01	7.30E-01

HQ = Hazard Quotient
-- = not a COC for this receptor

Table 3-20
SMA 4 Groundwater - Risk Characterization Summary
Receptors Exposed to Chemicals in Groundwater via Vapor Intrusion
ERP Coke Facility, Birmingham, AL

	Industrial Worker Receptors	
On-site COPCs	**ELCR**	**HQ**
Vinylchloride	**3.20E-05**	**2.10E-01**
Benzene	**2.60E-03**	**3.10E+01**
1,2-Dichloroethane	**7.70E-06**	**1.20E-01**
Trichloroethene	1.70E-07	5.70E-02
Toluene	--	**1.80E-01**
Chlorobenzene	--	**2.60E+02**
m,p-Xylenes	--	2.30E-02
1,2,4-Trichlorobenzene	--	**2.20E-01**
1,4-Dichlorobenzene	**2.00E-05**	6.40E-03
Naphthalene	3.80E-07	1.00E-02
Totals	**2.66E-03**	**2.92E+02**

ELCR = excess lifetime cancer risk
HQ = hazard quotient
BOLD represents ELCRs greater than 1E-06 and noncancer HQs greater than 0.1.
-- = no carcinogenic toxicity data are available

Table 3-21
SMA 4 - Site-Wide Risk Summary
All Receptors, Areas, and Media
ERP Coke Facility, Birmingham, Alabama

	Industrial/Commercial Worker		Construction Worker		Adolescent Trespasser		Adult Residents		Child Residents	
Media/Area	**ELCR**	**HQ**	**ELCR**	**HQ**	**ELCR**	**HQ**	**ELCR**	**HQ**	**ELCR**	**HQ**
Current Exposure Scenarios										
Surface Soil, 0 - 1 ft	4.6E-05	7.8E-02	6.7E-07	3.5E-02	5.6E-06	1.4E-02	--	--	--	--
Subsurface Soil, 2 - 15 ft	9.5E-07	1.2E-02	4.2E-06	8.3E-01	--	--	--	--	--	--
Mineral Wool Pile	1.1E-06	2.6E-03	--	--	--	--	1.9E-07	8.6E-05	2.3E-07	1.7E-04
Groundwater - Direct Contact*	--	--	5.6E-04	3.7E+02	--	--	--	--	--	--
Groundwater - Vapor Intrusion	2.7E-03	2.9E+02	--	--	--	--	--	--	--	--
Total Current Scenarios	**2.7E-03**	**2.9E+02**	**5.6E-04**	**3.7E+02**	5.6E-06	1.4E-02	1.9E-07	8.6E-05	2.3E-07	1.7E-04
Future Exposure Scenarios										
Surface Soil, 0 - 1 ft	4.6E-05	7.8E-02	6.7E-07	3.5E-02	5.6E-06	1.4E-02	--	--	--	--
Subsurface Soil, 2 - 15 ft	9.5E-07	1.2E-02	4.2E-06	8.3E-01	--	--	--	--	--	--
Mineral Wool Pile	1.1E-06	2.6E-03	--	--	--	--	1.9E-07	8.6E-05	2.3E-07	1.7E-04
Groundwater - Direct Contact*	1.3E-02	3.3E+02	5.6E-04	3.7E+02	--	--	--	--	--	--
Groundwater - Vapor Intrusion	2.7E-03	2.9E+02	--	--	--	--	--	--	--	--
Total Future Scenarios	**1.6E-02**	**6.2E+02**	**5.6E-04**	**3.7E+02**	5.6E-06	1.4E-02	1.9E-07	8.6E-05	2.3E-07	1.7E-04

ELCR = Excess Lifetime Cancer Risk
HQ = Hazard Quotient
na = not applicable; toxicity factors are not available for these chemicals
* = includes inhalation of vapors while trenching for construction workers

Table 3-22
SMA 4, Surface Soil, 0 - 1 ft - Preliminary Cleanup Standards Summary
ERP Coke Facility, Birmingham, Alabama
all units mg/Kg

Chemical of Concern	Target Risk Level			Target Hazard Quotient		
	1.0E-04	1.0E-05	1.0E-06	3.0	1.0	0.1
Industrial Workers						
Benz(a)anthracene	290	29	2.9			
Benzo(a)pyrene	29	2.9	0.3			
Benzo(b)fluoranthene	290	29	2.9			
Dibenz(a,h)anthracene	29	2.9	0.3			
Indeno(1,2,3-cd)pyrene	291	29	2.9			
Arsenic	194	19	1.9			
Chromium	649	65	6.5			

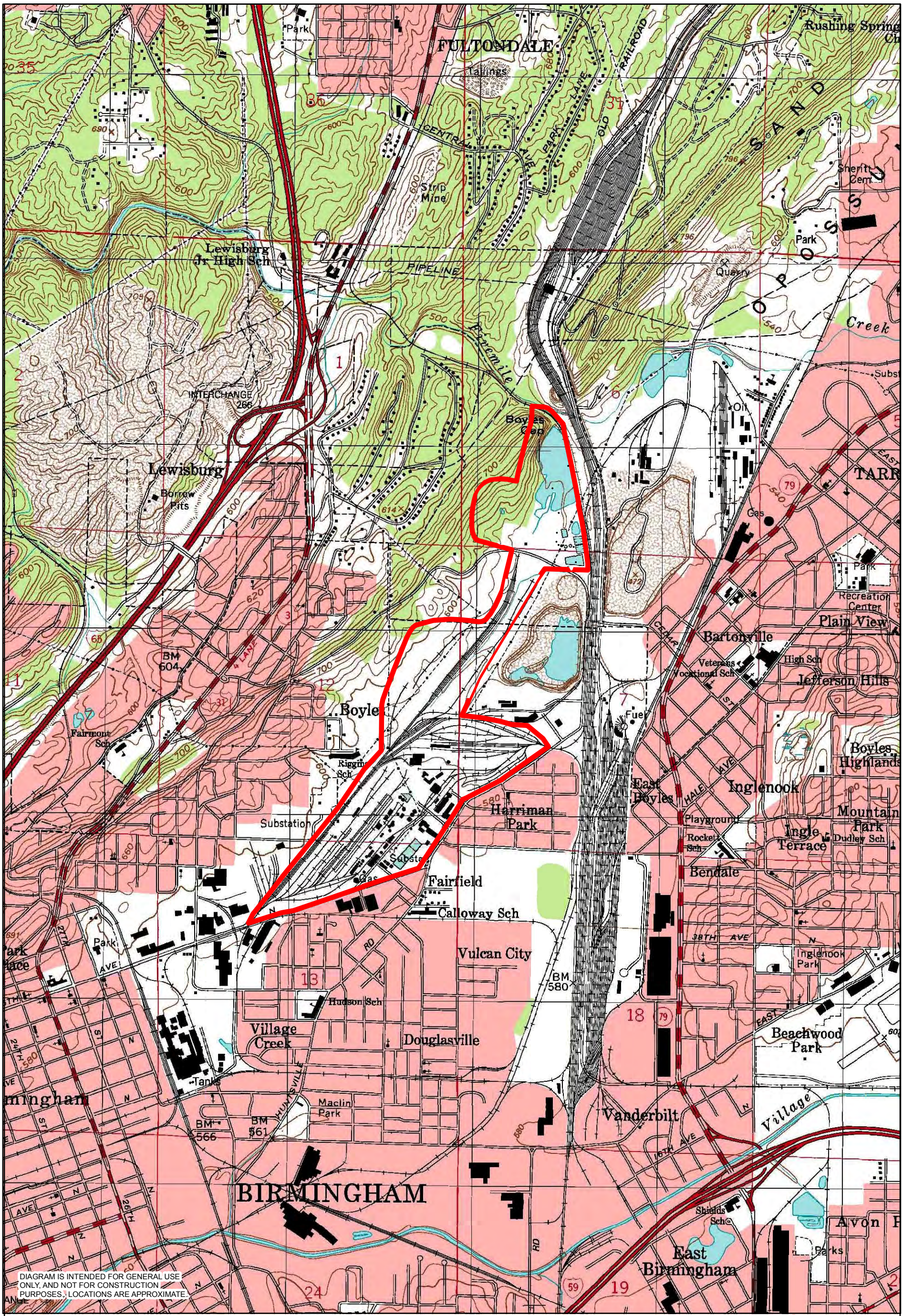
Table 3-23
SMA 4, Subsurface Soil, 2 - 15 ft - Preliminary Cleanup Standards Summary
ERP Coke Facility, Birmingham, Alabama
all units mg/Kg

	Target Risk Level			Target Hazard Quotient		
Chemical of Concern	**1.0E-04**	**1.0E-05**	**1.0E-06**	**3.0**	**1.0**	**0.1**
Construction Workers						
Benzo(a)pyrene	281	28	2.8			
Benzene				1,226	409	41
Chlorobenzene				3,514	1,171	117
Toluene				65,355	21,785	2,179

Table 3-24
SMA 4 - Preliminary Cleanup Standards Summary for Groundwater
ERP Coke Facility, Birmingham, Alabama
all units µg/L

		Target Risk Level			Target Hazard Quotient		
Chemical of Concern	**MCLs**	**1.0E-04**	**1.0E-05**	**1.0E-06**	**3.0**	**1.0**	**0.1**
Industrial Workers							
Benzene	5	149	15	1.5	385	128	12
Chlorobenzene	100				784	261	26
Toluene	1000				15,835	5,278	527
Trichloroethene	5				28.6	9.54	0.95
Vinyl chloride	2	37	3.7	0.37	624	208	21
1,2,4-Trichlorobenzene	70	390	39	3.9	36	12	1.2
1,2-Dichloroethane	5	54	5.4	0.54	117	39	3.9
Cis-1,2-Dichloroethene	70				607	202	20.2
1,4-Dichlorobenzene	75	146	15	1.5			
1,4-Dioxane		170	17	1.7			
Benzoo(a)anthracene		0.8	0.08	0.008			
Benzo(a)pyrene	0.2	0.05	0.005	0.0005			
Benzo(b)fluoranthene		0.9	0.09	0.009			
Dibenz(a,h)anthracene		0.03	0.003	0.003			
Indeno[1,2,3-cd]pyrene		0.3	0.03	0.003			
Methylene chloride	5	--	--	--	1,641	547	54.7
Naphthalene		51.8	5.18	0.518	54.4	18.1	1.81
Pentachlorophenol	1	5.1	0.51	0.051	110	36.8	3.7
Construction Worker							
Benzene	5	3,273	327	33	337	110	11
Chlorobenzene	100				666	222	22
Trichloroethene	5				28.6	9.54	0.95
Vinyl chloride	2	4,660	466	46.6	950	317	31.7
1,2-Dichloroethane	5	1,172	117	11.7	93.7	31.2	3.12
1,4-Dichlorobenzene	75	3,274	327	32.7			
1,2,4-Trichlorobenzene	70				35	12	1.2
Naphthalene					47	16	1.6
Toluene	1000				49,145	16,382	1,638

MCLs = maximum contaminant levels (per USEPA Regional Screening Level Table, May 2016)



Legend

Facility Boundary

TOPOGRAPHIC
North Birmingham, AL
7.5 Minute Quadrangle, USGS, 1997

0 2,500 Feet

Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

Terracon
110 12th St. North Birmingham, Alabama 35203
Phone: (205) 942-1289 Fax: (205) 443-5302

FACILITY LOCATION MAP

ERP Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
1-1

BTF Process Area and Sewers - SMA 1
SWMU #13 - Equalization Basin
SWMU #14 - pH Neutralization Basin
SWMU #15 - Primary Clarifier
SWMU #16 - Aeration Basin
SWMU #17 - Secondary Clarifier
SWMU #18 - Thickener
SWMU #19 - Digester
SWMU #20 - Dewatering Machine
SWMU #21 - Former Emergency Basin
SWMU #22 - Polishing Pond
SWMU #40 - Historic Drainage Ditch
SWMU #41 - Former Impoundment
AOC A - Pipe Outfall into Ditch next to BTF Area
AOC F - BTF Groundwater Plume

Land Disposal Area (LDA) - SMA 2
SWMU #4 - BTF Sewer
SWMU #23 - Biological Sludge Disposal Area
SWMU #24 - Blast Furnace Emission Control Sludge Piles A and B
SWMU #25 - Stormwater Ditch
SWMU #38 - Construction Debris Landfill
SWMU #39 - Blast Furnace Emission Control Sludge Waste Pile

Coke Manufacturing Plant - SMA 3
SWMU #1 - Quench Towers & Sumps
SWMU #2 - Quench Tower Pump Basins
SWMU #3 - Old Quench Tower Settling Basins
SWMU #5 - Coal Tar Storage Area Drain System
SWMU #6 - Spill Area Around Diesel Tank
SWMU #7 - Coal Tar Collection Sump
SWMU #8 - Flushing Liquor Decanter
SWMU #9 - Flushing Liquor Decanter Sump
SWMU #10 - Coal Tar Decanter
SWMU #11 - Coal Tar Decanter
SWMU #12 - Coal Tar Decanter
SWMU #37 - BTF Sewer Tar Trap
AOC E - Coke Plant Groundwater Plume

Former Pig Iron Foundry (PIF) - SMA 5
SWMU #43 - Pig Machine Slurry Pits
SWMU #44 - Blast Furnace Ash Boiler Pit
SWMU #45 - Slag Drying Beds
AOC C - Former Pig Iron Foundry

Former Chemical Plant (FCP) - SMA 4
SWMU #26 - Main Process Building
SWMU #27 - Floor Drain System
SWMU #28 - Sulfonation Floor Drain
SWMU #29 - Product Tank Containment Area
SWMU #30 - Centrifuge Waste Water Tank
SWMU #31 - Monohydrate Floor Drain and Sump
SWMU #32 - Drum Storage Area
SWMU #33 - Plant Drum Storage Area
SWMU #34 - Wastewater Neutralization System
SWMU #35 - Mineral Wool Waste Piles
SWMU #36 - Used Oil Tank
SWMU #42 - Former Aboveground Storage tanks (ASTs)
AOC B - Drainage Ditch next to Shuttlesworth Drive and 35th Ave.
AOC D - Former Chemical Plant [FCP] Groundwater Plume

SWMU 40
SWMU 22
SWMU 23
SWMU 41
AOC F
SWMU 18
SWMU 19
SWMU 17
SWMU 15
SWMU 24 A
SWMU 16
SWMU 20
AOC A
SWMU 24 B
SWMU 14
SWMU 13
SWMU 21
SWMU 25
SWMU 38
SWMU 39
SWMU 04
SWMU 43
SWMU 44
AOC C
SWMU 45
SWMU 37
SWMU 36
SWMU 35
SWMU 42
SWMU 06
SWMU 11
SWMU 27
AOC D
SWMU 29
SWMU 31
SWMU 28
AOC E
SWMU 30
SWMU 10
SWMU 09
SWMU 26
SWMU 12
SWMU 33
SWMU 05
SWMU 34
SWMU 07
SWMU 08
SWMU 01
SWMU 32
SWMU 03
SWMU 02
AOC B

DIAGRAM IS INTENDED FOR GENERAL USE ONLY, AND NOT FOR CONSTRUCTION PURPOSES. LOCATIONS ARE APPROXIMATE.

Solid Waste Management Areas (SMAs)
- BTF Process Area and Sewer - SMA 1
- Land Disposal Area - SMA 2
- Coke Manufacturing Plant - SMA 3
- Former Chemical Plant - SMA 4
- Former Pig Iron Foundary - SMA 5

Note:
1) SWMU - Solid Waste Management Unit
2) Management Area boundaries are approximations
3) AOC - Area of Concern

0 250 500 1,000 Feet

N

Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

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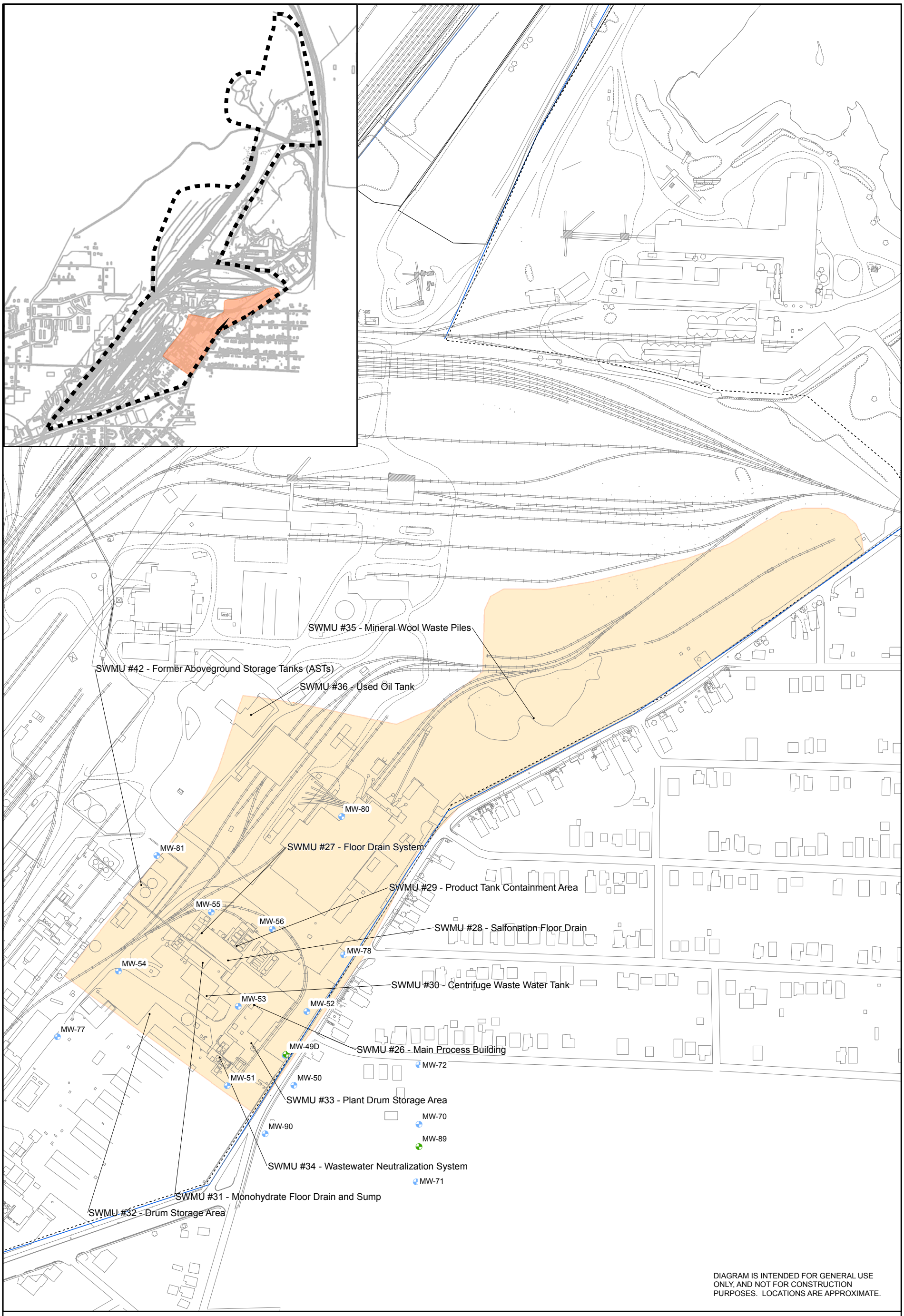
Phone: (205) 942-1289 Fax: (205) 443-5302

SITE MAP

ERP Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
1-2



Legend

- Shallow Bedrock Monitoring Well
- Deep Bedrock Monitoring Well
- Residium or Mixed Monitoring Well
- Non-Conasauga Limestone Monitoring Well
- Base

Note:
1) SWMU - Solid Waste Management Unit
2) Management Area boundaries are approximations
3) AOC - Area of Concern

0 120 240 480 Feet

N

Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

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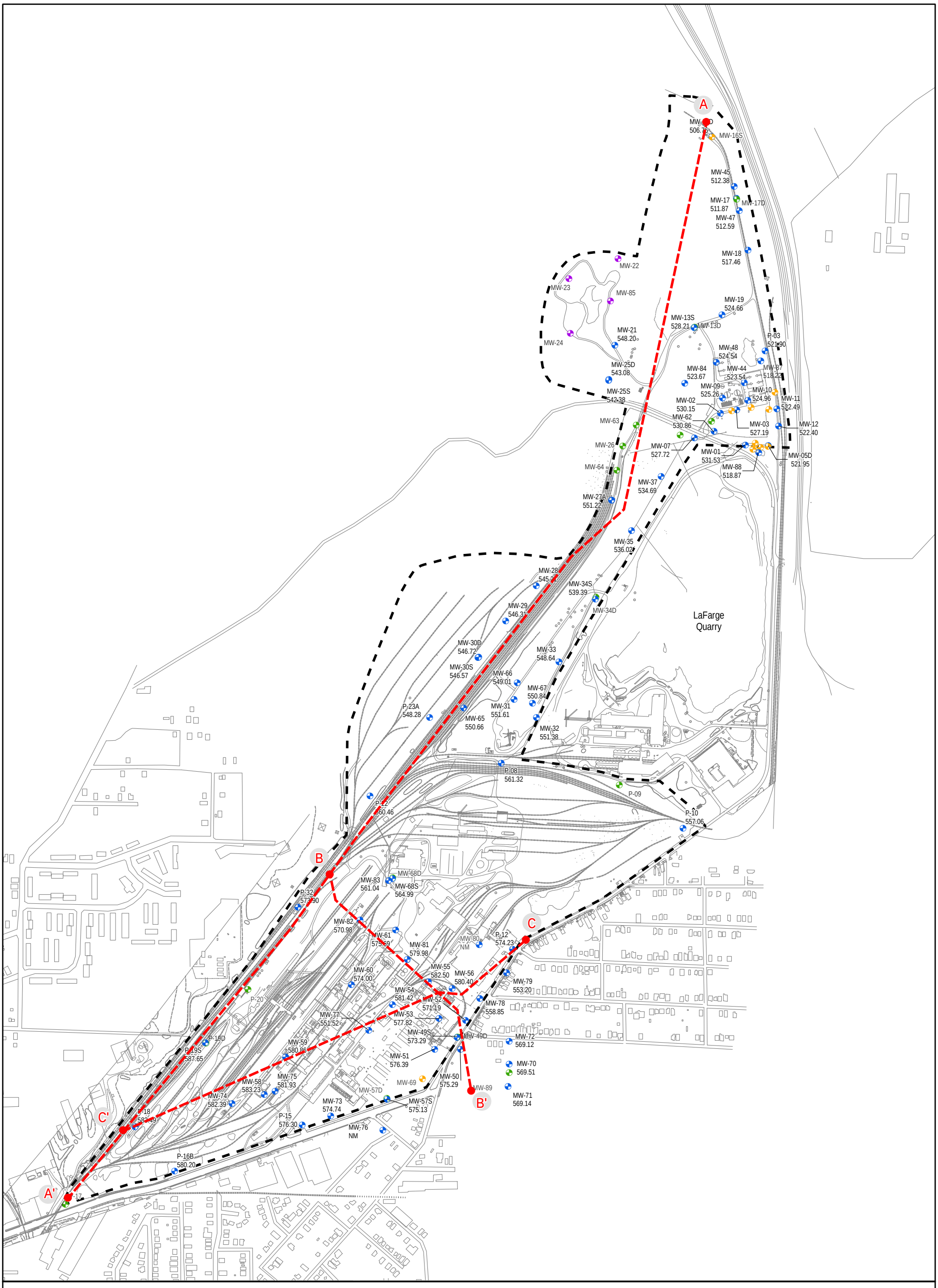
110 12th St. North Birmingham, Alabama 35203
Phone: (205) 942-1289 Fax: (205) 443-5302

COKE MANUFACTURING PLANT MAP

ERP Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
1-3



Legend

- Shallow Bedrock Monitoring Well
- Deep Bedrock Monitoring Well
- Residuum or Mixed Monitoring Well
- Non-Conasauga Limestone Monitoring Well
- Geologic Cross Section Location

0 250 500 1,000 Feet

N

Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

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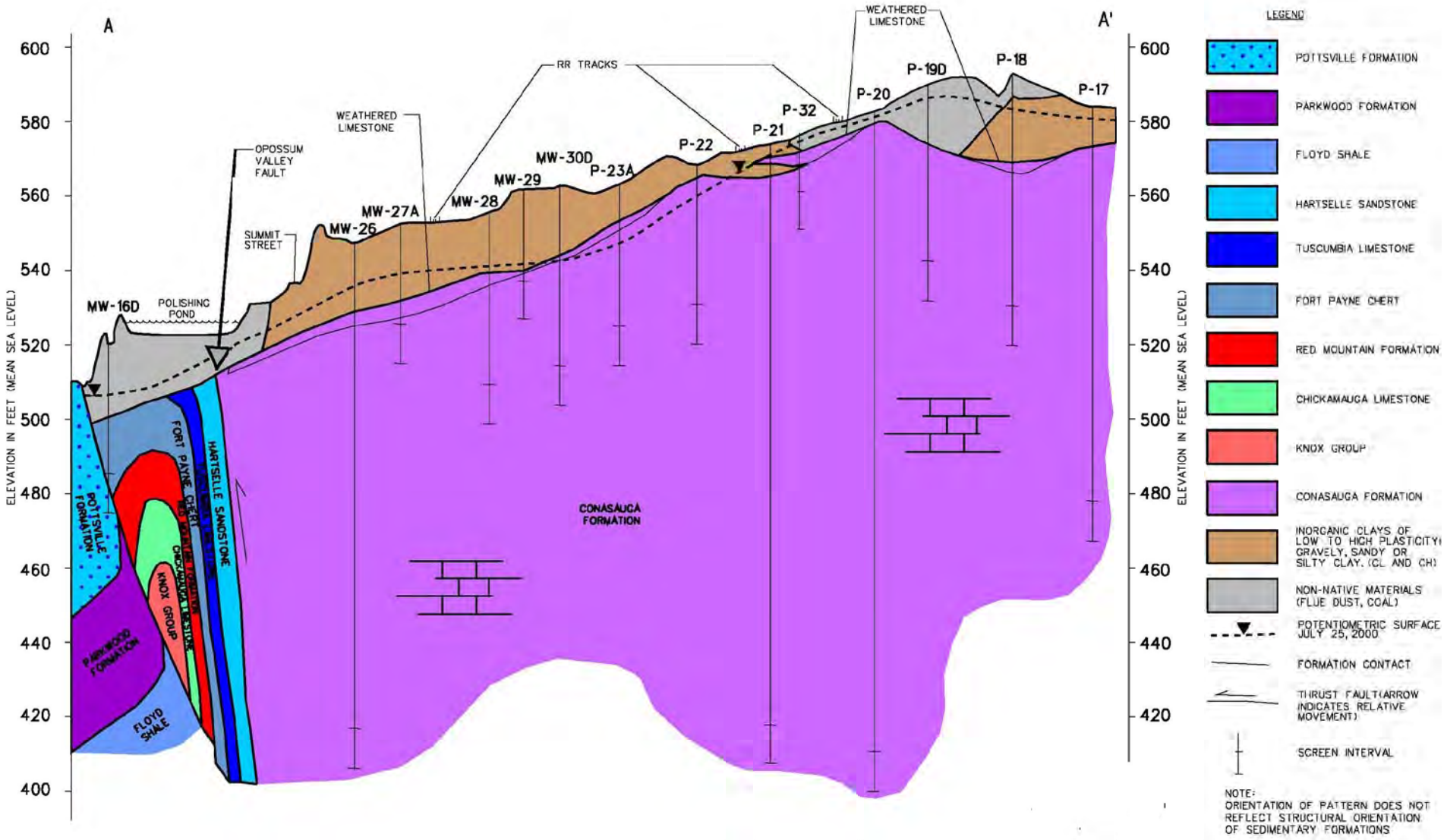
Phone: (205) 942-1289 Fax: (205) 443-5302

GEOLOGIC CROSS-SECTION LOCATION MAP

ERP Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
1-4

\\MONTGOMERY\GROUPS\GIS\SLOSS\BHM_2008\RFI\SECTION_2\2_8_SB_POT.MXD WMOORE4 3/25/2009 15:49:56



Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

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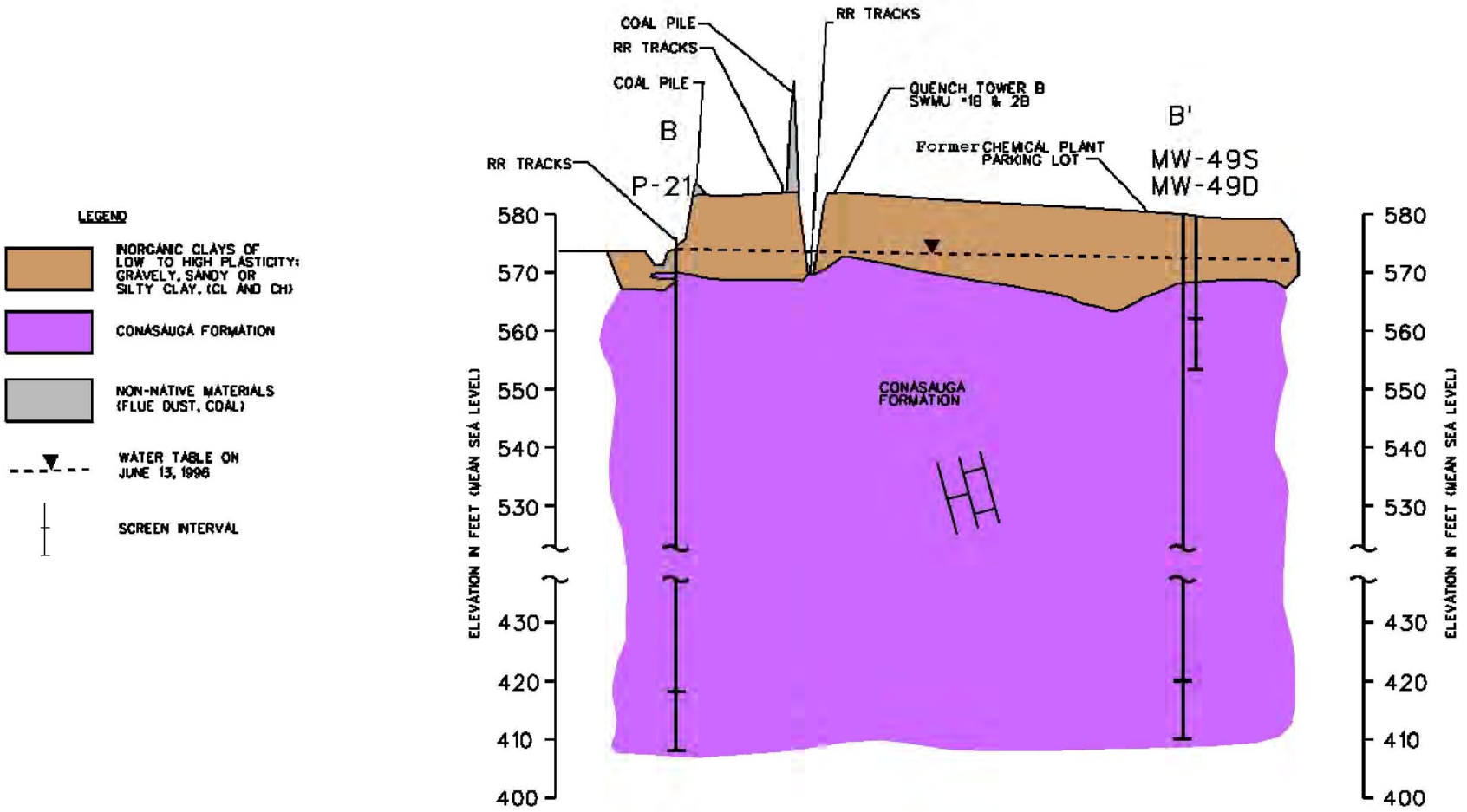
Phone: (205) 942-1289 Fax: (205) 443-5302

GEOLOGIC CROSS SECTION A-A'

ERP Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
1-5



Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

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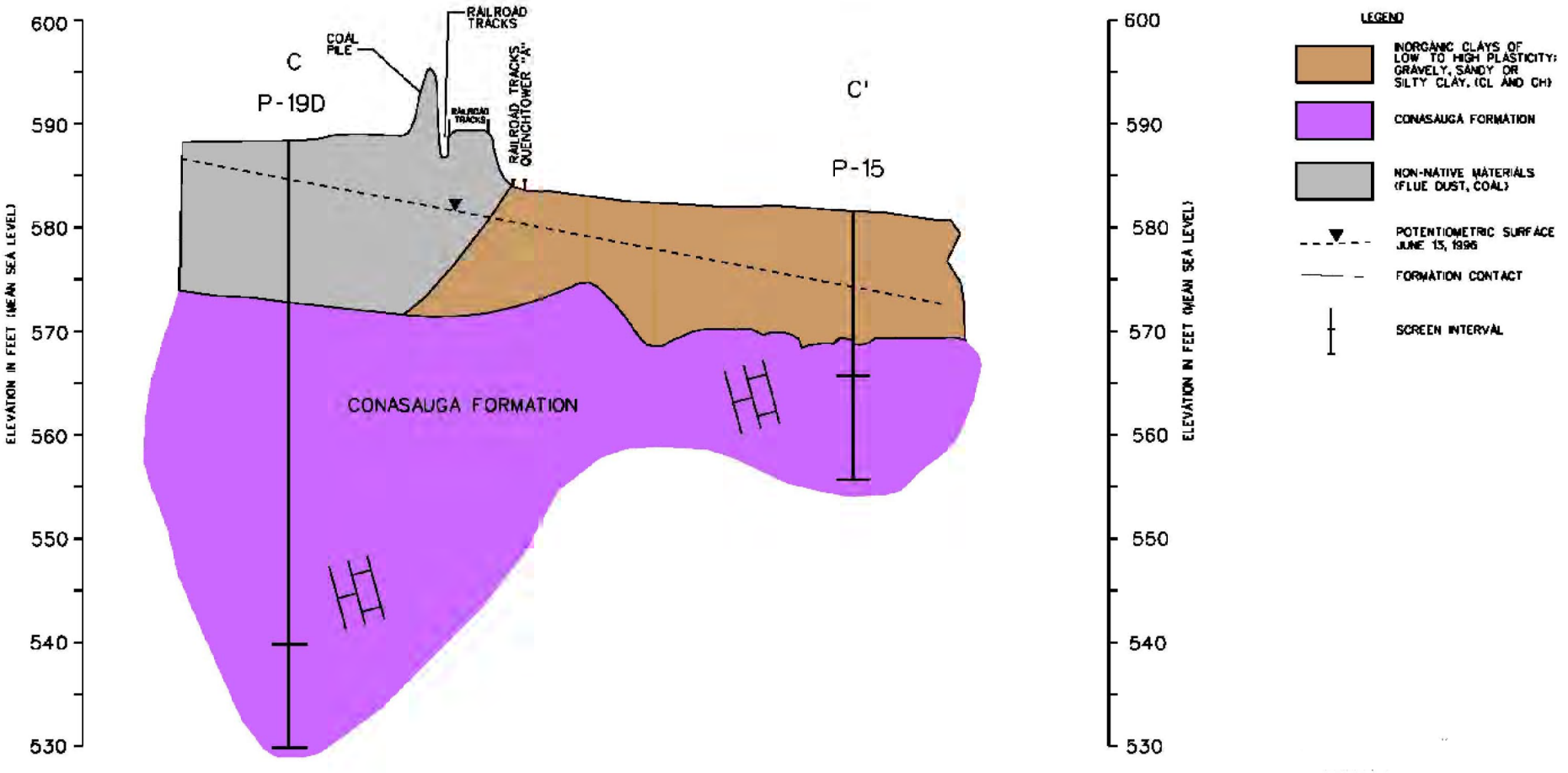
Phone: (205) 942-1289 Fax: (205) 443-5302

GEOLOGIC CROSS SECTION B-B'

ERP Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
1-6



Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

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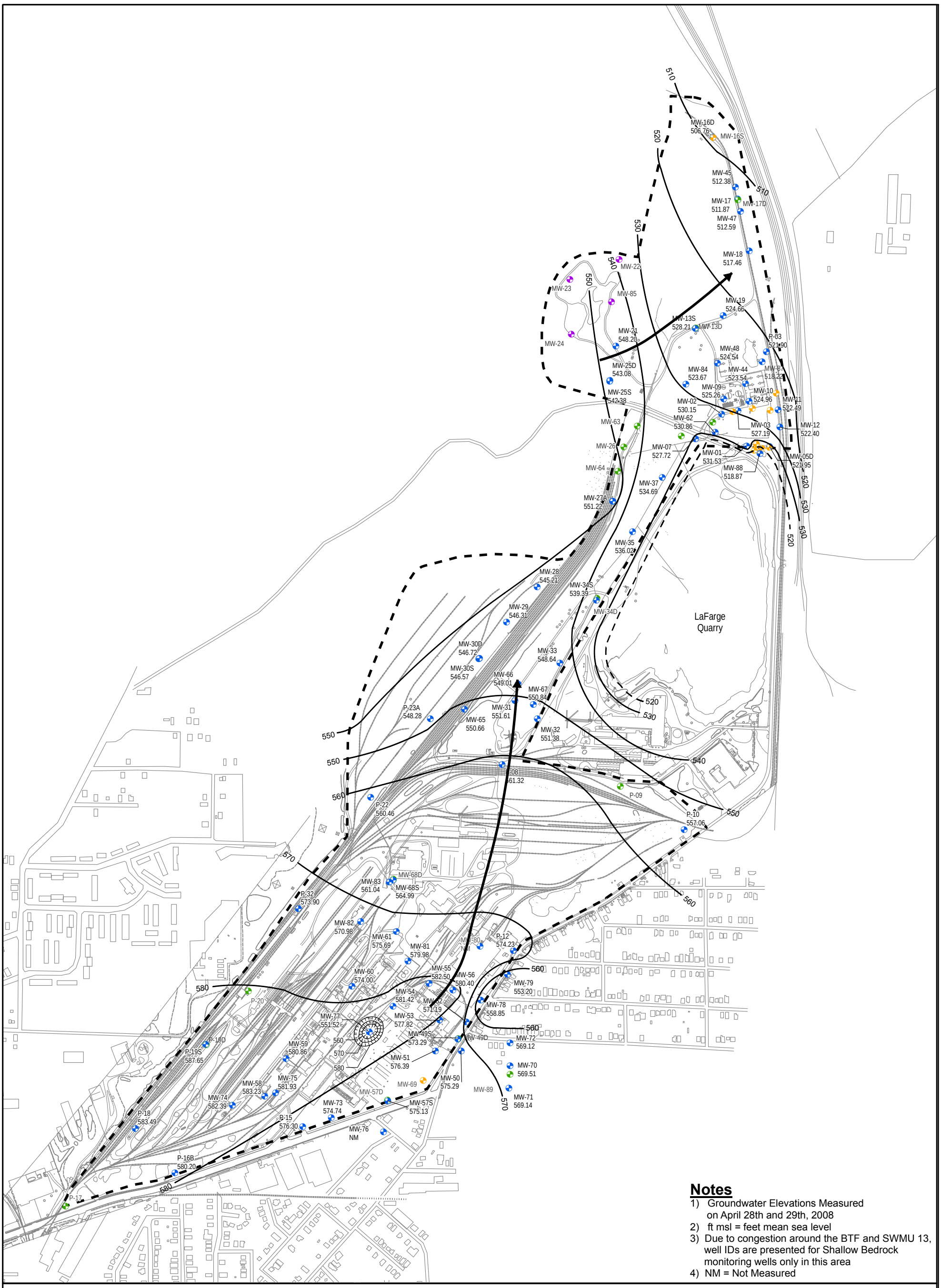
110 12th St. North Birmingham, Alabama 35203
Phone: (205) 942-1289 Fax: (205) 443-5302

GEOLOGIC CROSS SECTION C-C'

ERP Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
1-7



Notes

1) Groundwater Elevations Measured on April 28th and 29th, 2008
2) ft msl = feet mean sea level
3) Due to congestion around the BTF and SWMU 13, well IDs are presented for Shallow Bedrock monitoring wells only in this area
4) NM = Not Measured

Legend

- Shallow Bedrock Monitoring Well
- Deep Bedrock Monitoring Well
- Residuum or Mixed Monitoring Well
- Non-Conasauga Limestone Monitoring Well
- 540 — Groundwater Elevation Contour
- 580.20 Shallow Bedrock Groundwater Elevation (ft msl)

0 250 500 1,000 Feet

N

Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

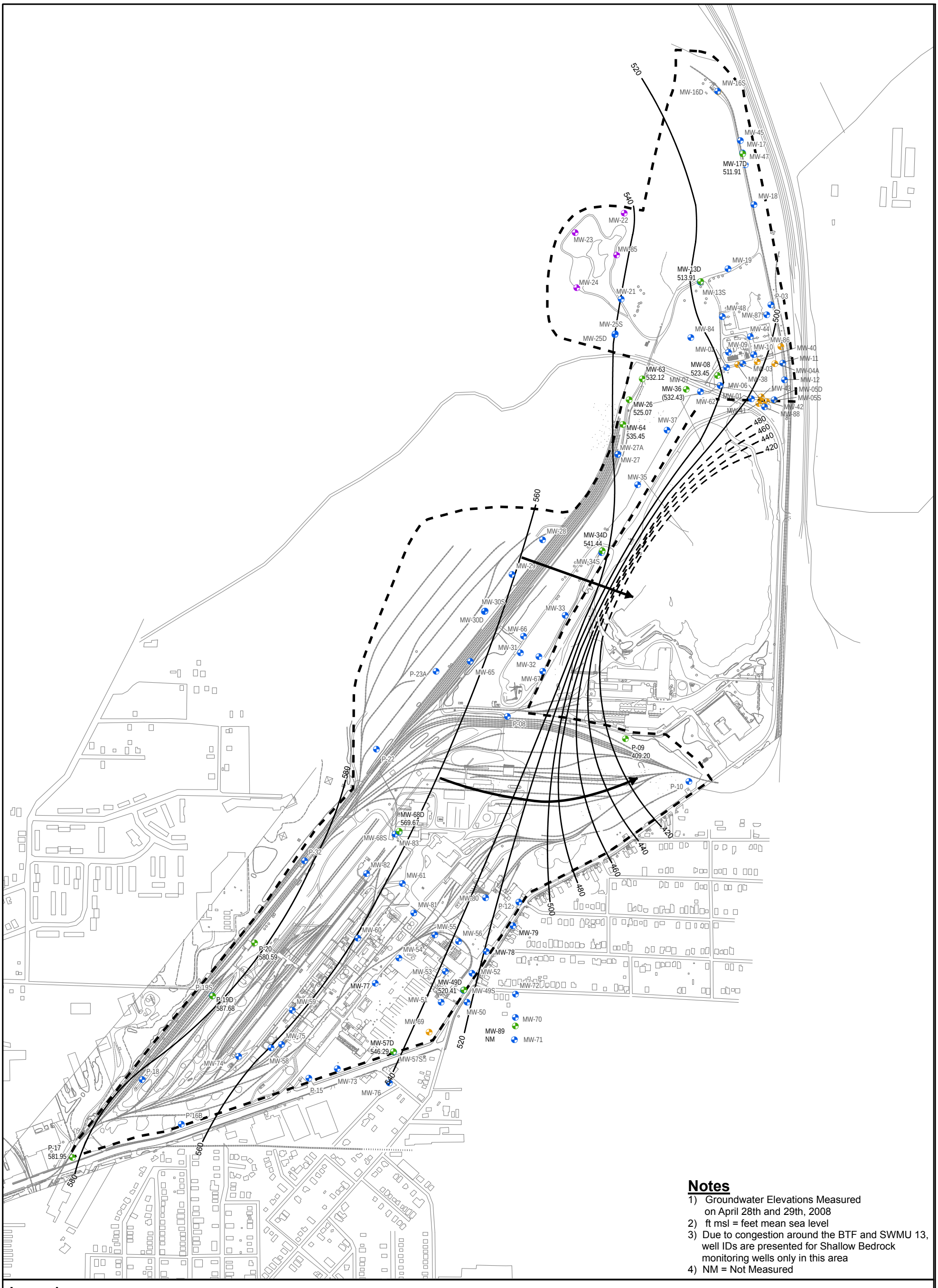
Terracon
110 12th St. North Birmingham, Alabama 35203
Phone: (205) 942-1289 Fax: (205) 443-5302

SHALLOW BEDROCK POTENTIOMETRIC SURFACE MAP

ERP Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
1-8

\\MONTGOMERY\GROUPS\GIS\SLOSS\BHM_2008\RFI\SECTION_2\2_8_SB_POT.MXD WMOORE4 3/25/2009 15:49:56



Notes

1) Groundwater Elevations Measured on April 28th and 29th, 2008
2) ft msl = feet mean sea level
3) Due to congestion around the BTF and SWMU 13, well IDs are presented for Shallow Bedrock monitoring wells only in this area
4) NM = Not Measured

Legend

- Shallow Bedrock Monitoring Well
- Deep Bedrock Monitoring Well
- Residuum or Mixed Monitoring Well
- Non-Conasauga Limestone Monitoring Well
- 540 — Groundwater Elevation Contour
- 551.42 Deep Bedrock Groundwater Elevation (ft msl)

0 250 500 1,000 Feet

N

Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

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110 12th St. North Birmingham, Alabama 35203
Phone: (205) 942-1289 Fax: (205) 443-5302

DEEP BEDROCK POTENTIOMETRIC SURFACE MAP

ERP Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
1-9

\\MONTGOMERY\GROUPS\GIS\SLOSS\BHM_2008\RFI\SECTION_2\2_9_DB_POT.MXD WMOORE4 3/25/2009 16:09:15

NOTES:
- Elevations measured Nov. 18 - 20, 2014 by Terracon

DATA SOURCES:
- Well locations: CH2M Hill
- Basemap imagery: ESRI

N

Project No.:	E1147243
Drawn By:	JDF
Reviewed By:	TWR
Date:	July 2015

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Consulting Engineers & Scientists
110 12th Street North Birmingham, Al 35203
PH. (205) 942 1289 terracon.com

NOVEMBER 2014
POTENTIOMETRIC SURFACE MAP

ERP Coke
3500 35th AVENUE NORTH
BIRMINGHAM, ALABAMA

Figure
1-10

NOTES:
- Elevations measured February 23, 2015 by Terracon

DATA SOURCES:
- Well locations: CH2M Hill
- Basemap imagery: ESRI

N

Project No.:	E1147243
Drawn By:	JDF
Reviewed By:	TWR
Date:	July 2015

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Consulting Engineers & Scientists
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PH. (205) 942 1289 terracon.com

FEBRUARY 2015
POTENTIOMETRIC SURFACE MAP

ERP Coke
3500 35th AVENUE NORTH
BIRMINGHAM, ALABAMA

Figure
1-11

NOTES:
- Elevations measured May 19 - 21, 2015 by Terracon

DATA SOURCES:
- Well locations: CH2M Hill
- Basemap imagery: ESRI

N

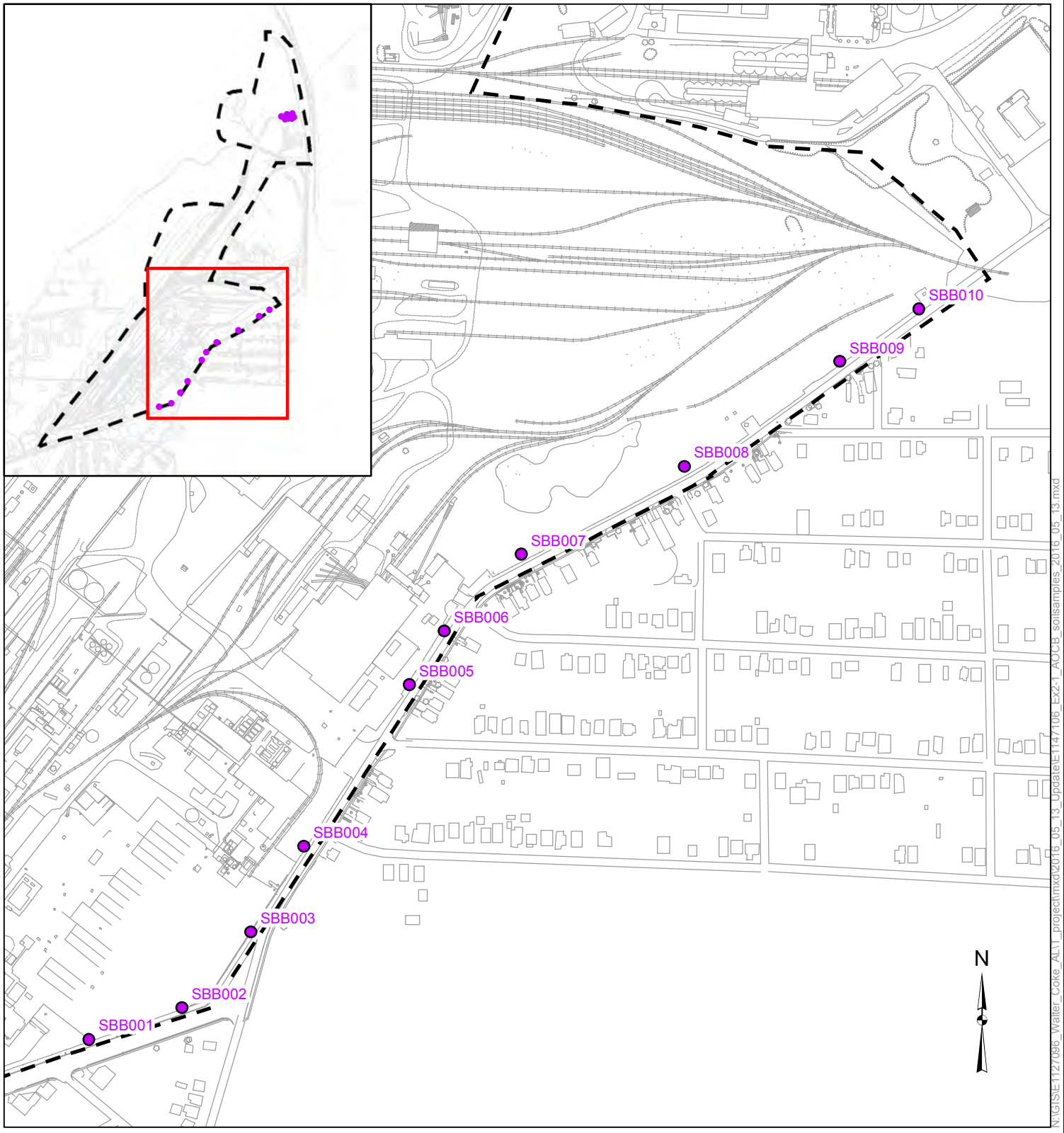
Project No.:	E1147243
Drawn By:	JDF
Reviewed By:	TWR
Date:	July 2015

Terracon
Consulting Engineers & Scientists
110 12th Street North Birmingham, Al 35203
PH. (205) 942 1289 terracon.com

MAY 2015
POTENTIOMETRIC SURFACE MAP

ERP Coke
3500 35th AVENUE NORTH
BIRMINGHAM, ALABAMA

Figure
1-12



Surficial Soil Samples (November 2015)

Facility Boundary

0 200 400 800 Feet

Project No.	E1147106
Drawn By:	IMS
Reviewed By:	TWR
Date:	May 2016

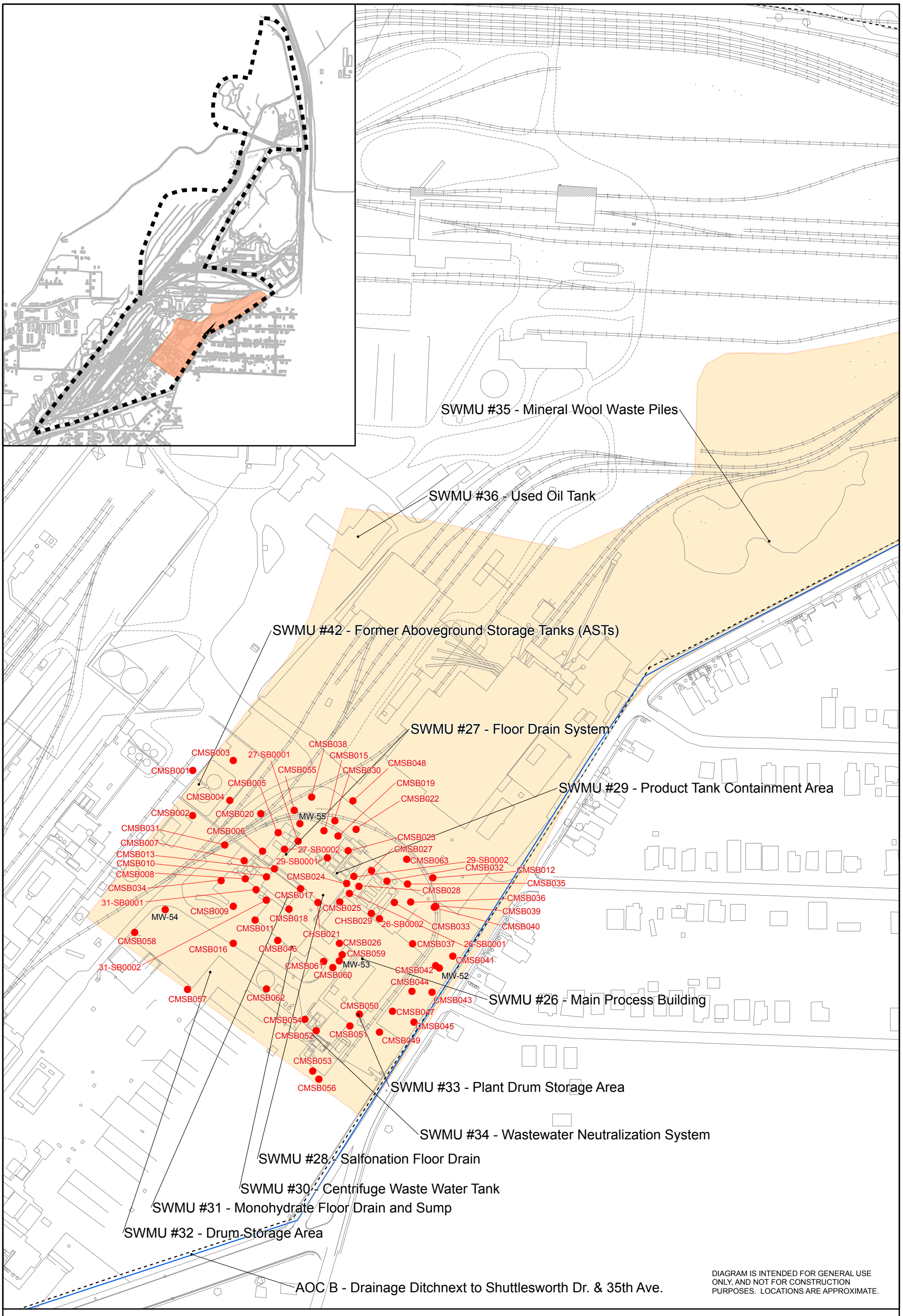
Terracon
110 12th Street North Birmingham, Al 35203
PH. (205) 942 1289 terracon.com

AOC B Surficial Soil Sample Location Map

ERP COKE, INC.
3500 35th AVENUE NORTH
BIRMINGHAM, ALABAMA

Figure

2-1



Legend

- Soil Sample

Note:
1) SWMU - Solid Waste Management Unit
2) Management Area boundaries are approximations
3) AOC - Area of Concern

0 80 160 320 Feet

N

Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

Terracon
110 12th St. North Birmingham, Alabama 35203
Phone: (205) 942-1289 Fax: (205) 443-5302

Subsurface Soil Location Map

Walter Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
3-1

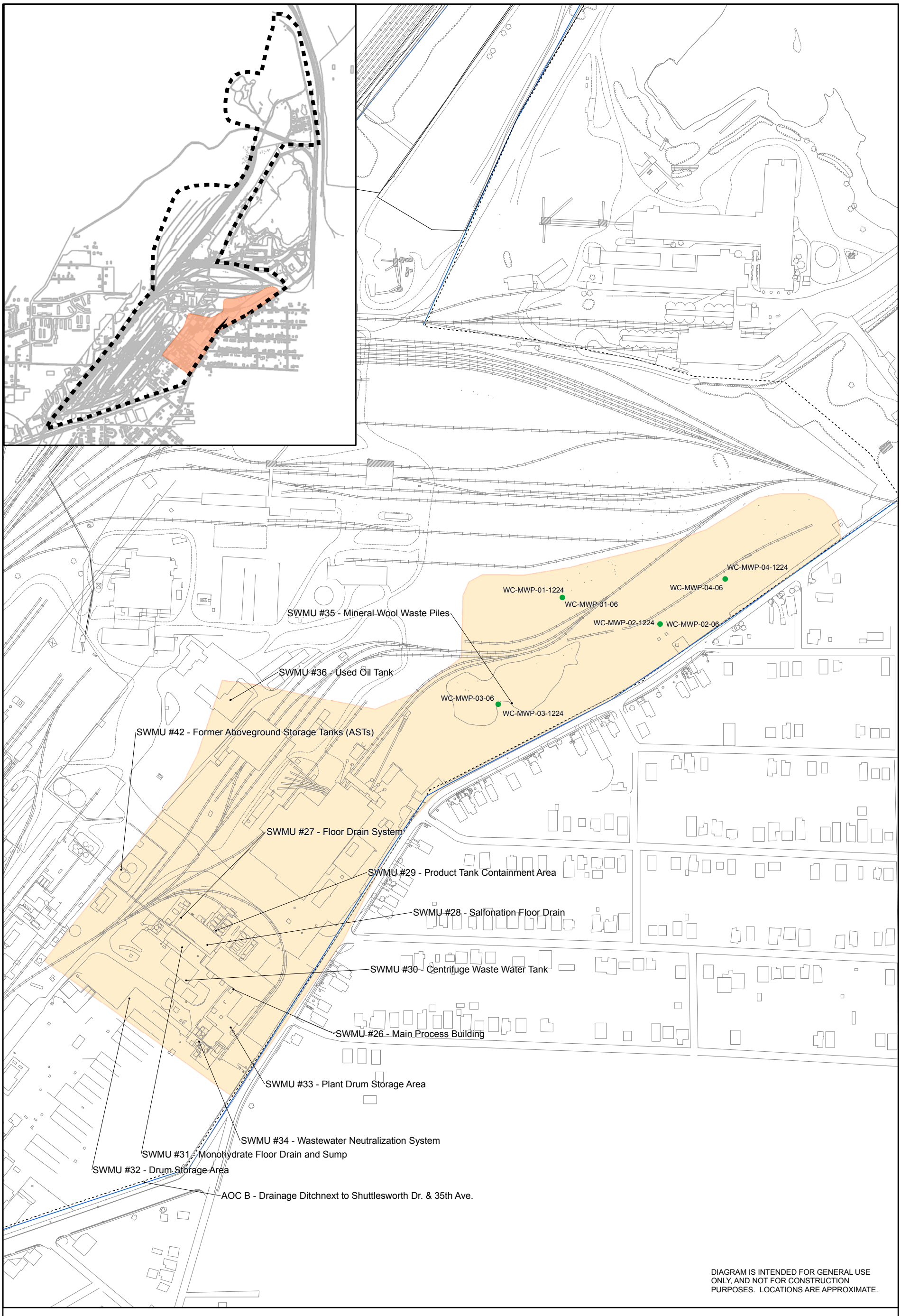


DIAGRAM IS INTENDED FOR GENERAL USE ONLY, AND NOT FOR CONSTRUCTION PURPOSES. LOCATIONS ARE APPROXIMATE.

Legend

- Rockwool Revert Slag (RRS) Samples

Note:
1) SWMU - Solid Waste Management Unit
2) Management Area boundaries are approximations
3) AOC - Area of Concern

0 120 240 480 Feet

N

Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

Terracon
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Phone: (205) 942-1289 Fax: (205) 443-5302

ROCKWOOL REVERT SLAG SAMPLE LOCATION MAP

Walter Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
3-2

SWMU #35 - Mineral Wool Waste Piles
SWMU #36 - Used Oil Tank
SWMU #42 - Former Aboveground Storage Tanks (ASTs)
SWMU #27 - Floor Drain System
SWMU #29 - Product Tank Containment Area
SWMU #28 - Salfonation Floor Drain
SWMU #30 - Centrifuge Waste Water Tank
SWMU #26 - Main Process Building
SWMU #33 - Plant Drum Storage Area
SWMU #34 - Wastewater Neutralization System
SWMU #31 - Monohydrate Floor Drain and Sump
SWMU #32 - Drum Storage Area
AOC B - Drainage Ditchnext to Shuttlesworth Dr. & 35th Ave.

MW-80
MW-81
MW-55
MW-56
MW-78
MW-54
MW-53
MW-52
MW-77
MW-49D
MW-49S
MW-51
MW-50
MW-72
MW-70
MW-89
MW-90
MW-71

DIAGRAM IS INTENDED FOR GENERAL USE ONLY, AND NOT FOR CONSTRUCTION PURPOSES. LOCATIONS ARE APPROXIMATE.

Legend

- Shallow Bedrock Monitoring Well
- Deep Bedrock Monitoring Well
- Residium or Mixed Monitoring Well
- Non-Conasauga Limestone Monitoring Well
- Base

Note:
1) SWMU - Solid Waste Management Unit
2) Management Area boundaries are approximations
3) AOC - Area of Concern

0 120 240 480 Feet

N

Date:	2/20/2014
PM:	TWR
Project:	E1137227
Author:	94

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Phone: (205) 942-1289 Fax: (205) 443-5302

GROUNDWATER SAMPLE LOCATION MAP

Walter Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
3-3

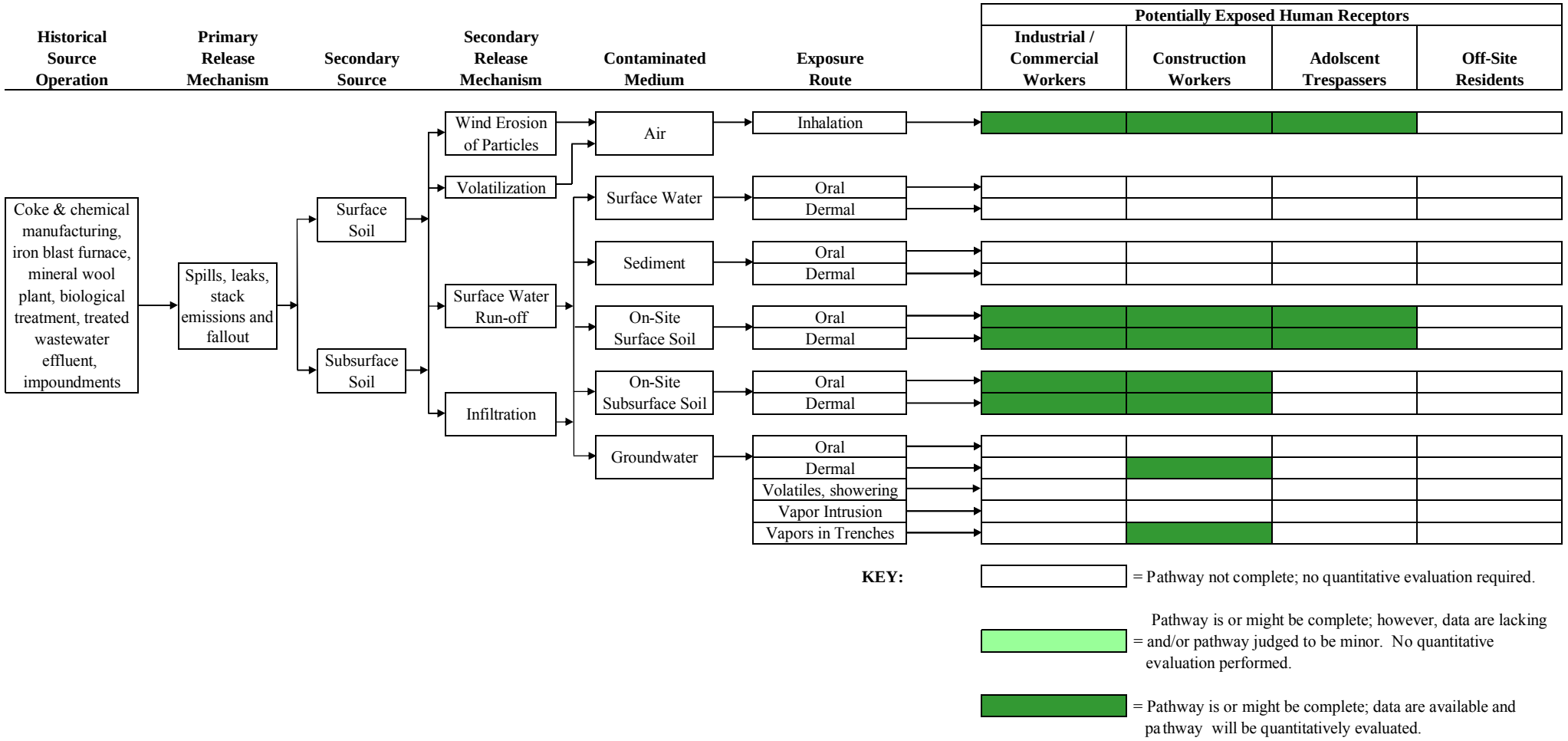


Figure 3-4. SMA 4. Conceptual Site Model - Current Exposure Scenarios. ERP Coke, Birmingham, AL

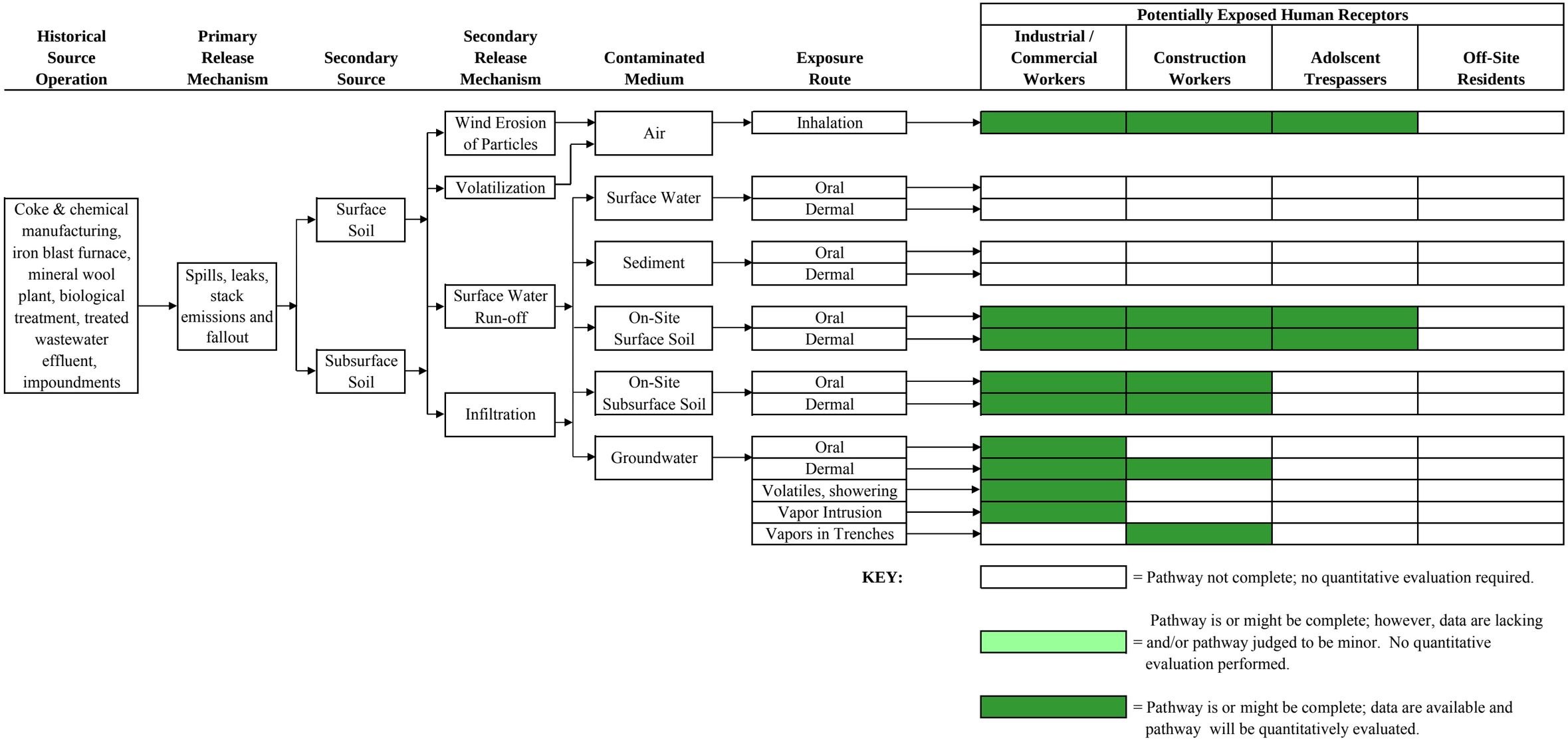


Figure 3-5. SMA 4. Conceptual Site Model - Future Exposure Scenarios. ERP Coke, Birmingham, AL

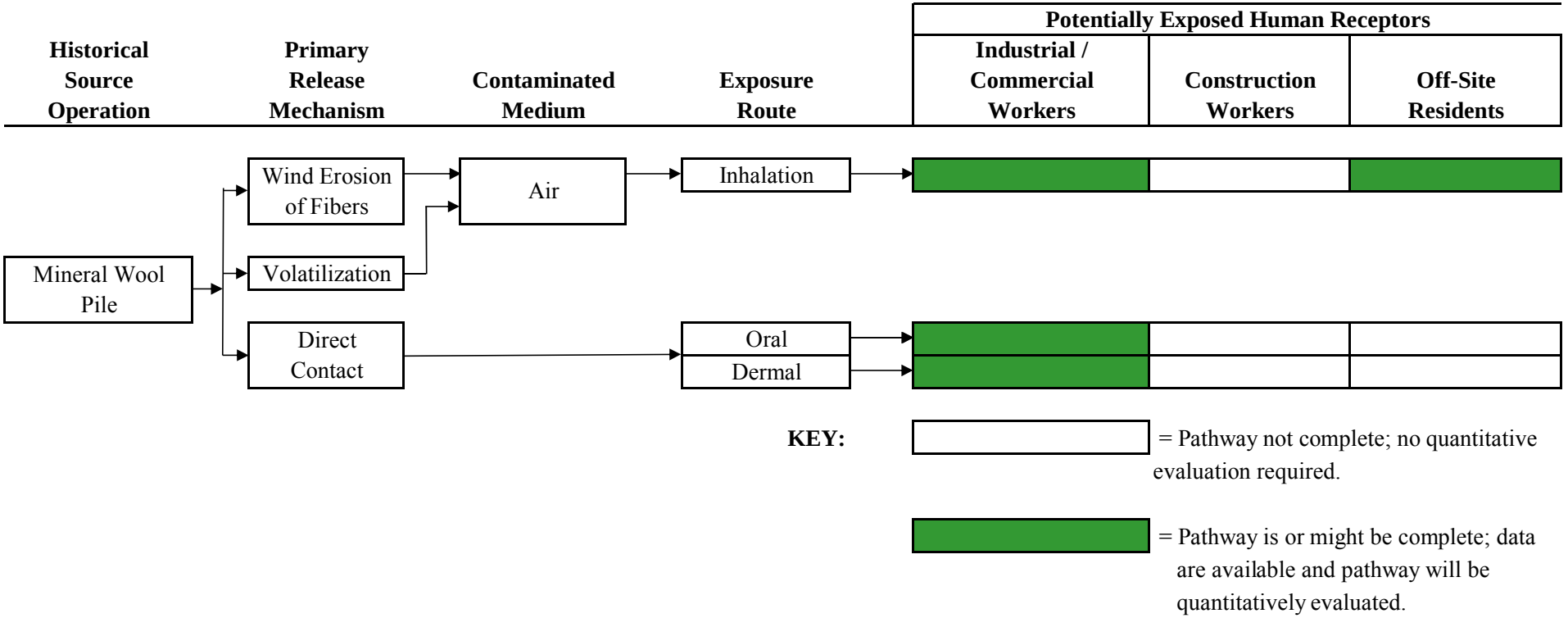
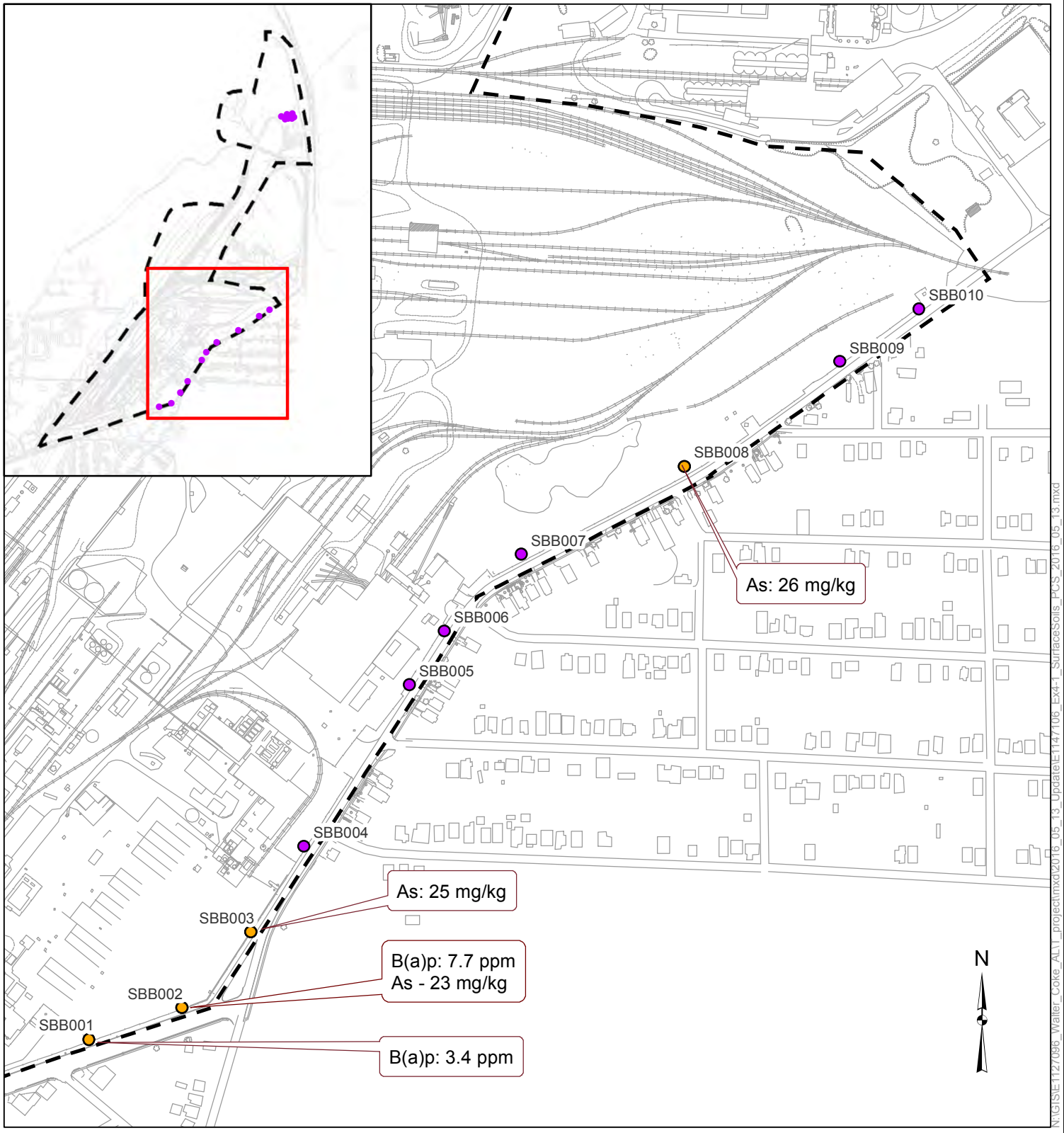


Figure 3-6. SMA 4, SWMU 35 Mineral Wool Pile. Conceptual Site Model, Current and Future Exposure Scenarios. ERP Coke, Birmingham, AL



Samples Exceeding PCS

Surficial Soil Samples (November 2015)

Facility Boundary

0 200 400 800 Feet

NOTES:
- PCS - Preliminary Cleanup Standard
- All concentrations in mg/Kg
- B(a)P = Benzo(a)pyrene
- As = Arsenic

Project No.	E1147106
Drawn By:	IMS
Reviewed By:	TWR
Date:	May 2016

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110 12th Street North Birmingham, Al 35203
PH. (205) 942 1289 terracon.com

Surface Soil Samples > PCS

ERP COKE, INC.
3500 35th AVENUE NORTH
BIRMINGHAM, ALABAMA

Figure

4-1

CM-SB030:

Chlorobenzene - 170 ppm

CM-SB018:

Toluene - 56000 ppm

CM-SB033:

Benzene - 760 ppm

CM-SB029:

Benzo(a)pyrene - 29 ppm

CM-SB050:

Benzo(a)pyrene - 98 ppm

DA8-SB001
MW-61
CO-TG099
MW-80
CO-TG063
CO-TG098
MW-81
CM-SB003
EI_07
CM-SB001
CM-SB004
CM-SB038
CM-SB020
CM-SB055
MW-55
CM-SB030
CW-5
CM-SB005
CM-SB015
CM-SB019
CM-SB022
CO-TG077
27-SB0001
CM-SB006
27-SB0002
CM-SB023
MW-56
29-SB0001
CM-SB063
EI_09
CM-SB027
29-SB0002
CM-SB012
CM-SB024
CM-SB028
CM-SB032
CM-SB035
MW-78
CO-TG078
CO-TG102
CM-SB034
CM-SB017
26-SB0001
CW-6
CM-SB021
CM-SB025
CM-SB033
CM-SB009
CM-SB018
CO-TG101
MW-54
CW-4
CM-SB029
CM-SB011
CM-SB058
CO-TG103
CM-SB016
CM-SB046
CM-SB037
CM-SB041
CM-SB042
MW-52
CM-SB044
CM-SB043
MW-77
CM-SB050
CM-SB047
CM-SB054
CM-SB051
OSE16-F-C
OSE16-L-C
CM-SB052
SV40771
OSE16-B-C
EI_10
SV40772
CS40811 SV40811
CM-SB053
MW-51
CM-SB056
SV40812
CW-1
HPD-SD001
HPD-SD002
SBB003
DA9-SB001
MW-90
EI_12
MW-69

Legend

Facility Boundary

SMA - Former Chemical Plant

Sampling Station Locations

Sample Locations Exceeding PCS

No Exceedance

N

0 50 100 200 Feet

NOTES:
- PCS - Preliminary Cleanup Standard

Project No.	E1147106
Drawn By:	IMS
Reviewed By:	TWR
Date:	May 2016

Terracon
110 12th Street North Birmingham, Al 35203
PH. (205) 942 1289 terracon.com

Subsurface Soil Samples > PCS

ERP COKE, INC.
3500 35th AVENUE NORTH
BIRMINGHAM, ALABAMA

Figure

4-2

E:\GIS\WalterCoke_PortableMaps\E1147106_Ex4-2_SubSurfSoil_PCSExceed_2016_05_13.mxd

DA8-SB001
MW-61
CO-TG099
MW-80
CO-TG063
CO-TG098
MW-81
CM-SB003
EI_07
CM-SB001
CM-SB004
CM-SB038
CM-SB048
CM-SB002
CM-SB020
CM-SB055
CM-SB030
MW-55
CM-SB005
CM-SB015
CW-5
CM-SB022
CM-SB019
CO-TG077
27-SB0001
CM-SB031
CM-SB006
27-SB0002
MW-56
CM-SB023
29-SB0001
CM-SB007
CM-SB063
EI_08
CM-SB013
EI_09
CM-SB027
29-SB0002
CM-SB010
CM-SB012
CM-SB034
CM-SB008
CM-SB032
CM-SB035
CM-SB024
MW-78
CO-TG078
CO-TG102
31-SB0001
CM-SB017
26-SB0001
CW-6
31-SB0002
CM-SB021
CM-SB025
CM-SB033
CM-SB036
CM-SB039
CM-SB040
CM-SB009
CM-SB018
CO-TG101
MW-54
CW-4
CM-SB029
26-SB0002
CM-SB011
CM-SB058
CO-TG103
CM-SB016
CM-SB046
CW-3
CM-SB026
CM-SB037
CM-SB059
CM-SB041
CM-SB061
MW-53
CM-SB042
MW-52
CM-SB060
CM-SB057
CM-SB062
CM-SB044
CM-SB043
MW-77
CM-SB050
CM-SB047
CM-SB054
SBB004
CM-SB045
OSE16-F-C
OSE16-L-C
CM-SB051
CM-SB052
CM-SB049
MW-49D
MW-49S
SV40771
OSE16-B-C
EI_10
CW-2
SV40772
CS40811
SV40811
CM-SB053
MW-50
CM-SB056
MW-51
SV40812
CW-1
HPD-SD001
HPD-SD002
SBB003
DA9-SB001
MW-90
EI_12
MW-69

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Legend

Facility Boundary

SMA - Former Chemical Plant

Sampling Station Locations

Sample Locations Exceeding GWP SSL (see table for details)

Other Sample Locations

N

0 50 100 200

Feet

Project No.	E1147106
Drawn By:	IMS
Reviewed By:	TWR
Date:	May 2016

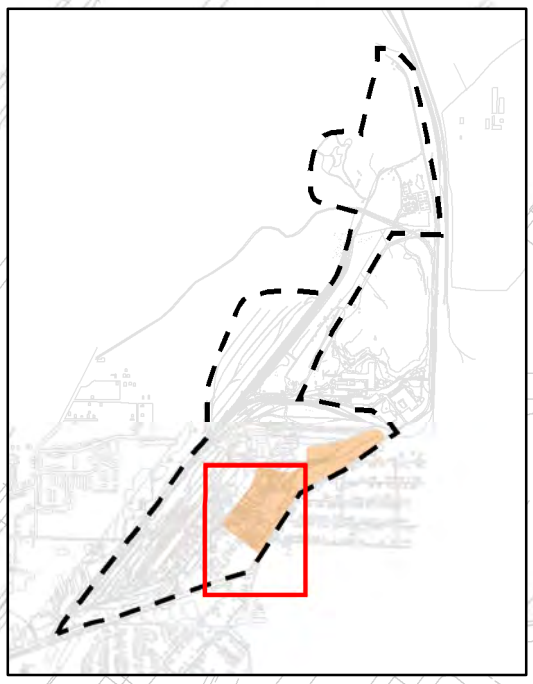
Terracon
110 12th Street North Birmingham, Al 35203
PH. (205) 942 1289 terracon.com

Subsurface Soil Samples > GWP SSL

ERP COKE, INC.
3500 35th AVENUE NORTH
BIRMINGHAM, ALABAMA

Figure

4-3



MW-55:

Benzene - 46000 ppb

Toulene - 43000 ppb

Chlorobenzene - 130000 ppb

MW-54:

Toluene - 3.40 ppb

Chlorobenzene - 560 ppb

MW-56:

Chlorobenzene - 2600 ppb

Benzene - 1600 ppb

MW-52:

Vinylchloride - 3.3 ppb

cis-1,2-Dichloroethene - 6.3 ppb

MW-49S:

Vinylchloride - 70 ppb

cis-1,2-Dichloroethene - 14 ppb

MW-51:

Vinylchloride - 170 ppb

cis-1,2-Dichloroethene - 150 ppb

Benzene - 12 ppb

MW-90:

cis-1,2-Dichloroethene - 1.30 ppb

MW-80
MW-81
MW-79
MW-60
MW-55
MW-56
MW-78
MW-54
MW-53
MW-52
MW-77
MW-49D
MW-49S
MW-72
MW-51
MW-70
MW-90
MW-89
MW-69
MW-71

Legend

Facility Boundary

Approximate VOC Plume > PCS

SMA - Former Chemical Plant

Monitoring Well Locations

MW Type

Shallow Bedrock Monitoring Well

Deep Bedrock Monitoring Well

N

0 75 150 300 Feet

NOTES:
- PCS - Preliminary Cleanup Standard

Project No.	E1147106
Drawn By:	IMS
Reviewed By:	TWR
Date:	May 2016

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110 12th Street North Birmingham, Al 35203
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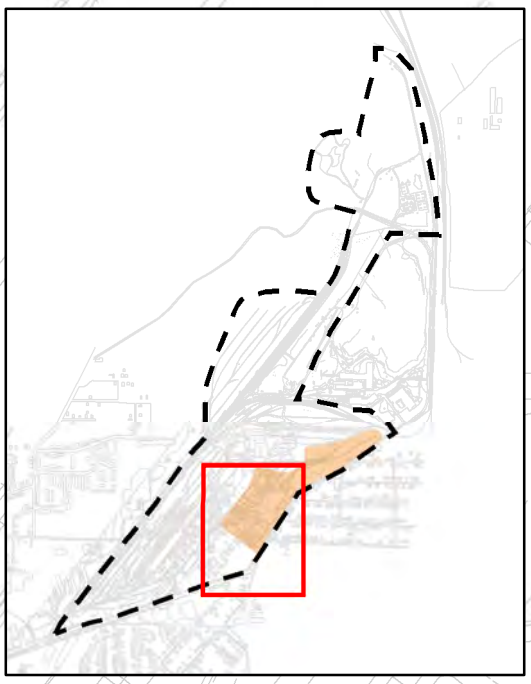
Groundwater Concentrations > PCS

ERP COKE, INC.
3500 35th AVENUE NORTH
BIRMINGHAM, ALABAMA

Figure

4-4

E:\GIS\WalterCoke_PortableMaps\E1147106_Ex4-4_GW_PCSExceed_2016_05_13.mxd



MW-55:

Benzene - 46000 ppb

Toulene - 43000 ppb

Chlorobenzene - 130000 ppb

MW-54:

Toluene - 3.40 ppb

Chlorobenzene - 560 ppb

MW-56:

Chlorobenzene - 2600 ppb

Benzene - 1600 ppb

MW-52:

Vinylchloride - 3.3 ppb

cis-1,2-Dichloroethene - 6.3 ppb

MW-49S:

Vinylchloride - 70 ppb

cis-1,2-Dichloroethene - 14 ppb

MW-51:

Vinylchloride - 170 ppb

cis-1,2-Dichloroethene - 150 ppb

Benzene - 12 ppb

MW-90:

cis-1,2-Dichloroethene - 1.30 ppb

MW-80 MW-81 MW-79 MW-60 MW-55 MW-56 MW-78 MW-54 MW-53 MW-52 MW-77 MW-49D MW-49S MW-72 MW-51 MW-70 MW-90 MW-89 MW-69 MW-71

Legend

Facility Boundary

Approximate VOC Plume > MCL

SMA - Former Chemical Plant

Monitoring Well Locations

MW Type

Shallow Bedrock Monitoring Well

Deep Bedrock Monitoring Well

N

0 75 150 300 Feet

NOTES:
- MCL - Maximum Contaminant Level

Project No.	E1147106
Drawn By:	IMS
Reviewed By:	TWR
Date:	May 2016

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Groundwater Concentrations > MCL

ERP COKE, INC.
3500 35th AVENUE NORTH
BIRMINGHAM, ALABAMA

Figure

4-5

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Table A-1
SMA-4, AOC B Surface Soil 0-1 ft, Surface Soil Analytical Results
ERP Coke

Chemical Name	SBB001 0 - 1 ft	SBB002 0 - 1 ft	SBB003 0 - 1 ft	SBB004 0 - 1 ft	SBB005 0 - 1 ft	SBB006 0 - 1 ft	SBB007 0 - 1 ft	SBB008 0 - 1 ft	SBB009 0 - 1 ft	SBB010 0 - 1 ft	PCS
VOLATILE ORGANIC CHEMICALS (mg/kg)											
Chloroform	0.0005 u	0.0005 u	0.0004 u	0.0004 u	0.0004 u	0.0005 u	**0.0078 j**	**0.007 j**	0.0003 u	0.0004 u	
SEMIVOLATILE ORGANIC CHEMICALS (mg/kg)											
1,2,4-Trichlorobenzene	0.400 u	0.420 u	0.035 u	0.040 u	**0.4100 j**	**0.170 j**	0.0340 u	**0.059 j**	0.033 u	0.037 u	
1,4-Dichlorobenzene	0.190 u	0.200 u	0.017 u	0.019 u	**0.0520 j**	**0.051 j**	0.0170 u	0.024 u	0.016 u	0.018 u	
Acetophenone	0.280 u	0.300 u	0.025 u	0.028 u	**0.1200 j**	**0.150 j**	0.025 u	0.036 u	0.023 u	**0.042 j**	
bis(2-Ethylhexyl)phthalate	0.650 u	0.680 u	0.058 u	**0.088 j**	**1**	**1.70**	0.0570 u	**0.094 j**	0.054 u	**0.5**	
Butyl benzyl phthalate	0.610 u	0.640 u	0.054 u	0.061 u	0.061 u	**0.077 j**	0.0530 u	0.077 u	0.051 u	**0.110 j**	
Carbazole	0.510 u	0.530 u	0.046 u	0.051 u	**0.130 j**	**0.170 j**	0.0440 u	0.065 u	0.042 u	**0.061 j**	
Dibenzofuran	0.280 u	**0.410 j**	**0.028 j**	**0.036 j**	**0.310 j**	**0.400 j**	0.025 u	**0.056 j**	0.023 u	**0.120 j**	
Phenanthrene[1]	**2**	**4.30**	**0.140**	**0.240**	**1.300**	**8.900**	**0.590**	**0.018 j**	**0.520**	**0.940**	
Pyrene	**2.9**	**7**	**0.067**	**0.220**	**0.650**	**3.800**	**0.550**	**0.023 j**	**0.980**	**0.440**	
2-Methylnaphthalene	**1.300**	**2.900**	**0.150**	**0.120**	**1.100**	**7.100**	**0.011 j**	**0.0096 j**	**0.055 j**	**0.880**	
Acenaphthene	**0.190**	**0.380**	**0.0076**	**0.012**	**0.064**	**0.430**	**0.024 j**	0.002 u	**0.019 j**	**0.039**	
Acenaphthylene[1]	**0.800**	**1.600**	**0.013**	**0.036**	**0.073**	**0.260**	**0.011 j**	**0.0089 j**	**0.25**	**0.066**	
Anthracene	**0.780**	**1.700**	**0.025**	**0.067**	**0.280**	**2**	**0.088**	0.009 u	**0.220**	**0.190**	
Benz(a)anthracene	**2.70**	**6.60**	**0.050**	**0.160**	**0.410**	**2.20**	**0.230**	**0.016 j**	**0.720**	**0.310**	**29**
Benzo(a)pyrene	3.4	7.70	**0.045**	**0.150**	**0.280**	**1.30**	**0.180**	**0.018 j**	**0.620**	**0.210**	**2.9**
Benzo(b)fluoranthene	**5.2**	**13**	**0.090**	**0.210**	**0.5**	**2.70**	**0.270**	**0.028 j**	**0.900**	**0.470**	**29**
Benzo(g,h,i)perylene[1]	**2.5**	**4.90**	**0.038**	**0.110**	**0.23**	**1.20**	**0.130**	0.014 u	**0.400**	**0.200**	
Benzo(k)fluoranthene	**2**	**4.90**	**0.022**	**0.075**	**0.16**	**0.80**	**0.088**	0.013 u	**0.340**	**0.140**	
Chrysene	**3.9**	**9.40**	**0.110**	**0.220**	**0.81**	**5.10**	**0.270**	**0.021 j**	**0.690**	**0.640**	
Dibenz(a,h)anthracene	**0.89**	**2.10**	**0.013**	**0.035**	**0.10**	**0.49**	**0.026 j**	0.016 u	**0.120**	**0.073**	**2.9**
Fluoranthene	**3.70**	**8.5**	**0.095**	**0.240**	**0.690**	**4.100**	**0.710**	**0.028 j**	**1.400**	**0.540**	
Fluorene	**0.27**	**0.58**	**0.015**	**0.019**	**0.200**	**1.900**	**0.021 j**	0.0059 u	**0.057 j**	**0.084**	
Indeno(1,2,3-cd)pyrene	**2.9**	**6.30**	**0.038**	**0.100**	**0.220**	**1.100**	**0.130**	**0.019 j**	**0.470**	**0.190**	**29**
Naphthalene	**1.5**	**3.30**	**0.140**	**0.140**	**0.870**	**5.800**	**0.02 j**	**0.017 j**	**0.340**	**0.680**	
INORGANIC CHEMICALS (mg/kg)											
Aluminum	**8500**	**8400**	**13000**	**9900**	**11000**	**16000**	**49000**	**24000**	**7000**	**9400**	
Arsenic	**18**	23	25	**15**	**6.70**	**11**	**8.80**	26	**13**	**13**	**19**
Barium	**97**	**120**	**78**	**120**	**160**	**210**	**420**	**150**	**89**	**160**	
Beryllium	**1.300**	**1.400**	**1.900**	**1.100**	**2**	**2.60**	**8.30**	**2.900**	**0.970**	**1.400**	
Cadmium	**0.390 j**	**0.560 j**	0.110 u	0.120 u	**0.330 j**	**0.590 j**	**0.290 j**	**0.920**	**0.230 j**	**0.720**	
Calcium	**6900**	**5600**	**3000**	**13000**	**95000**	**100000**	**220000**	**58000**	**230000**	**110000**	
Chromium	**33**	**33**	**68**	**38**	**33**	**41**	**48**	**62**	**22**	**44**	**65**
Cobalt	**11**	**8.10**	**18**	**16**	**4.80**	**5.30**	**4.5**	**15**	**9.10**	**9.20**	
Copper	**31**	**53**	**65**	**17**	**30**	**45**	**9.90**	**54**	**14**	**46**	
Iron (Ferric)	**25000**	**23000**	**54000**	**26000**	**14000**	**14000**	**17000**	**38000**	**20000**	**22000**	
Lead	**67**	**200**	**50**	**32**	**31**	**48**	**15**	**140**	**26**	**51**	
Magnesium	**2200**	**1400**	**830**	**3700**	**23000**	**20000**	**52000**	**8500**	**16000**	**14000**	
Manganese	**810**	**320**	**1500**	**940**	**870**	**930**	**2500**	**860**	**990**	**1200**	
Mercury	**0.47**	**0.80**	**0.0970**	**0.0520**	**0.059**	**0.095**	0.0091 u	**0.490**	**0.046**	**0.0780**	
Nickel	**14**	**18**	**12**	**14**	**13**	**16**	**7**	**22**	**10**	**15**	
Potassium	**920**	**810**	**670**	**740**	**1700**	**2600**	**6000**	**4500**	**1600**	**1200**	
Selenium	**1.900 j**	**1.300 j**	1 u	**1.30 j**	**2.10 j**	**4**	**2.20 j**	**11**	**1.10 j**	**1.60 j**	
Silver	**0.280 j**	**0.570 j**	0.0640 u	0.0730 u	**0.110 j**	**0.120 j**	**0.130 j**	**0.190 j**	0.0670 u	**0.1300 j**	
Vanadium	**37**	**30**	**69**	**42**	**23**	**29**	**40**	**47**	**22**	**30**	
Zinc	**390**	**410**	**140**	**470**	**160**	**300**	**31**	**500**	**160**	**240**	

Bolded concentrations represent detected results.
Highlighted concentrations exceed the calculated PCSs

Table A-2
SMA 4, Subsurface Soil 2 - 15 ft, - ERP Coke

Chemical Name	CM-SB0001 (2-4 ft) 14-Jan-08	CM-SB0002 (10-12 ft) 14-Jan-08	CM-SB0002 (2-4 ft) 14-Jan-08	CM-SB0002 (6-8 ft) 14-Jan-08	CM-SB0003 (2-4 ft) 14-Jan-08	CM-SB0003 (5-7 ft) 14-Jan-08	CM-SB0003 (8-10 ft) 14-Jan-08	CM-SB0004 (12-14 ft) 14-Jan-08	CM-SB0004 (2-4 ft) 14-Jan-08	CM-SB0004 (6-8 ft) 14-Jan-08	CM-SB0005 (2-4 ft) 15-Jan-08	CM-SB0005 (6-8 ft) 15-Jan-08	CM-SB0006 (12-14 ft) 15-Jan-08	CM-SB0006 (3-5 ft) 15-Jan-08	CM-SB0006 (7-9 ft) 15-Jan-08	CM-SB0007 (2-4 ft) 15-Jan-08	CM-SB0008 (2-4) ft 15-Jan-08	CM-SB0008 (5-7 ft) 15-Jan-08	CM-SB0009 (2-4 ft) 16-Jan-08	CM-SB0009 (8-10 ft) 16-Jan-08
1,1,2-Trichloroethane	0.0021 UJ	0.0013 U	0.097 U	0.001 U	0.00086 U	0.048 U	0.075 U	0.001 U	0.0011 U	0.0009 U	1.2 U	0.056 U	0.053 U	7.4 U	0.057 U	0.15 U	0.3 U	0.064 U	0.11 U	0.0011 U
1,2,4-Trichlorobenzene											0.049 U	0.053 U	0.049 U	0.056 U	0.052 U	0.053 U	0.053 U	0.057 U	0.057 U	0.055 U
1,2-Dichloroethane	0.0035 UJ	0.0022 U	0.16 U	0.0017 U	0.0014 U	0.08 U	0.12 U	0.0017 U	0.0019 U	0.0015 U	1.9 U	0.094 U	0.088 U	12 U	0.094 U	0.25 U	0.5 U	0.11 U	0.18 U	0.0019 U
1,2-Dichloropropane	0.0021 UJ	0.0013 U	0.097 U	0.001 U	0.00086 U	0.048 U	0.075 U	0.001 U	0.0011 U	0.0009 U	1.2 U	0.056 U	0.053 U	7.4 U	0.057 U	0.15 U	0.3 U	0.064 U	0.11 U	0.0011 U
1,4-Dichlorobenzene											0.041 U	0.044 U	0.041 U	0.046 U	0.043 U	0.044 U	0.044 U	0.048 U	0.048 U	0.046 U
2-Butanone (MEK)	0.019 UJ	0.012 U	0.89 U	0.0092 U	0.0079 U	0.44 U	0.68 U	0.0093 U	0.01 U	0.0082 U	11 U	0.52 U	0.49 U	68 U	0.52 U	1.4 U	2.7 U	0.59 U	0.97 U	0.01 U
Acetone	**0.056 J**	**0.0087 J**	0.41 UJ	**0.017 J**	0.0037 U	0.2 UJ	0.32 U	**0.043 =**	**0.011 J**	**0.015 J**	4.9 U	0.24 U	0.22 U	32 U	0.24 U	0.63 U	**1.2 J**	0.27 U	0.45 U	**0.012 J**
Benzene	**0.014 J**	0.0012 U	**0.97 J**	**0.058 =**	**0.0025 J**	**9.4 J**	**1.4 =**	**0.0015 J**	**0.15 =**	**0.093 J**	**21 =**	**0.46 =**	**11 =**	**400 =**	**5.7 =**	**32 =**	**5.4 =**	**1.7 =**	**11 =**	**0.0016 J**
Carbon disulfide	**0.0059 J**	0.00084 U	0.063 U	**0.0013 J**	0.00056 U	0.031 U	0.049 U	0.00066 U	**0.012 =**	**0.012 =**	0.76 U	0.037 U	0.034 U	4.8 U	0.037 U	0.097 U	0.19 U	0.042 U	0.068 U	**0.0027 J**
Carbon tetrachloride	0.0025 UJ	0.0015 UJ	0.11 U	0.0012 UJ	0.001 UJ	0.056 U	0.087 U	0.0012 U	0.0013 U	0.001 U	1.4 U	0.066 U	0.062 U	8.7 U	0.066 U	0.17 U	0.35 U	0.075 U	0.12 U	0.0013 U
Chlorobenzene	0.0019 UJ	0.0012 UJ	**0.091 J**	0.00092 UJ	0.00079 UJ	0.044 UJ	0.068 U	**0.002 J**	**0.012 =**	**0.01 J**	**300 =**	**3.7 =**	**5.3 =**	**190 =**	**11 =**	**1.7 =**	**89 =**	**35 =**	0.097 U	**0.002 J**
Chloroethane	0.0027 UJ	0.0016 U	0.12 U	0.0013 U	0.0011 U	0.06 U	0.093 U	0.0013 U	0.0014 U	0.0011 U	1.5 U	0.07 U	0.066 U	9.3 U	0.071 U	0.19 U	0.37 U	0.08 U	0.13 U	0.0014 U
Chloroform	0.0015 UJ	0.00089 UJ	0.067 UJ	0.00068 UJ	0.00059 UJ	0.033 UJ	0.051 U	0.0007 U	0.00077 U	0.00061 U	0.79 U	0.038 U	0.036 U	5.1 U	0.039 U	0.1 U	0.2 U	0.044 U	0.072 U	0.00078 U
cis-1,2-Dichloroethene	0.0017 UJ	0.001 U	0.078 U	0.0008 U	0.00069 U	0.039 U	0.06 U	0.00082 U	0.0009 U	0.00072 U	0.93 U	0.045 U	0.042 U	6 U	0.045 U	0.12 U	0.24 U	**0.35 =**	0.084 U	0.00091 U
cis-1,3-Dichloropropene	0.0018 UJ	0.0011 U	0.081 U	0.00083 U	0.00072 U	0.04 U	0.062 U	0.00085 U	0.00093 U	0.00075 U	0.97 U	0.047 U	0.044 U	6.2 U	0.047 U	0.12 U	0.25 U	0.054 U	0.088 U	0.00095 U
Ethylbenzene	0.0032 UJ	0.0019 U	**0.34 J**	0.0015 U	0.0013 U	0.072 U	0.11 U	0.0015 U	0.0017 U	0.0013 U	1.7 U	0.085 U	0.079 U	**33 =**	0.085 U	**1.2 =**	**7.5 =**	**0.4 =**	0.16 U	0.0017 U
m- and p-Xylenes	0.0013 UJ	0.0008 U	**1.8 =**	0.00062 UB	0.00053 U	0.03 UB	**0.19 J**	0.00063 U	0.00069 UB	0.00055 UB	**11 =**	0.035 U	0.033 U	**120 =**	**0.042 J**	**2.5 =**	**68 =**	**0.8 =**	**0.41 J**	0.0007 U
Methylene chloride	0.0028 UJ	0.0017 UB	0.13 U	0.0013 UB	0.0011 U	0.064 U	0.1 U	0.0014 U	0.0015 U	0.0012 U	1.6 U	0.075 U	0.071 U	9.9 U	0.075 U	**0.22 J**	0.4 U	0.086 U	0.14 U	0.0015 U
o-Xylene	0.0011 UJ	0.00065 U	**0.28 J**	0.0005 U	0.00043 U	0.024 U	**0.055 J**	0.00051 U	0.00056 UB	0.00045 U	0.58 U	0.028 U	0.026 U	**38 =**	0.028 U	**0.71 =**	**18 =**	0.032 U	**0.39 J**	0.00057 U
Styrene	0.0011 UJ	0.00066 UJ	0.05 UJ	0.00051 UJ	0.00044 UJ	0.024 UJ	0.038 U	0.00052 U	0.00057 U	0.00046 U	0.59 U	0.029 U	0.027 U	3.8 U	0.029 U	0.076 U	0.15 U	0.033 U	0.054 U	0.00058 U
Tetrachloroethene	0.0016 UJ	0.00097 UJ	0.073 UJ	0.00075 UJ	0.00065 UJ	0.036 UJ	0.056 U	0.00076 U	0.00084 U	0.00067 U	0.87 U	0.042 U	0.04 U	5.6 U	0.042 U	0.11 U	**2 =**	**0.66 =**	0.079 U	0.00086 U
Toluene	**1.7 =**	0.0011 U	**4.1 =**	**0.0022 J**	0.00072 U	**0.27 =**	**0.37 =**	**0.0019 J**	**0.0086 =**	**0.0031 J**	**17 =**	0.047 U	**1.7 =**	**15000 =**	**2.1 =**	**5.1 =**	**60 =**	**0.31 =**	**5.8 =**	**0.0053 =**
trans-1,2-Dichloroethene	0.0018 UJ	0.0011 U	0.08 U	0.00083 U	0.00071 U	0.04 U	0.062 U	0.00084 U	0.00093 U	0.00074 U	0.96 U	0.046 U	0.044 U	6.1 U	0.047 U	0.12 U	0.25 U	0.053 U	0.087 U	0.00094 U
trans-1,3-Dichloropropene	0.0017 UJ	0.001 U	0.079 U	0.00081 U	0.0007 U	0.039 U	0.06 U	0.00082 U	0.00091 U	0.00073 U	0.94 U	0.046 U	0.043 U	6 U	0.046 U	0.12 U	0.24 U	0.052 U	0.085 U	0.00092 U
Trichloroethene	0.0016 UJ	0.00097 UJ	0.073 UJ	0.00075 UJ	0.00065 UJ	0.036 UJ	0.056 U	0.00076 U	0.00084 U	0.00067 U	0.87 U	0.042 U	0.04 U	5.6 U	0.042 U	0.11 U	0.22 U	**0.32 =**	0.079 U	0.00086 U
Vinyl chloride	0.0028 UJ	0.0017 U	0.13 U	0.0013 U	0.0011 U	0.064 U	0.1 U	0.0014 U	0.0015 U	0.0012 U	1.6 U	0.075 U	0.071 U	9.9 U	0.075 U	0.2 U	0.4 U	0.086 U	0.14 UJ	0.0015 U
Xylenes	0.0023 UJ	0.0014 U	**2.1 =**	0.0011 U	0.00093 U	**0.07 J**	**0.25 J**	0.0011 U	0.0012 UB	0.00097 UB	**11 =**	0.061 U	0.057 U	**160 =**	0.061 U	**3.2 =**	**86 =**	**0.82 =**	**0.8 J**	0.0012 U
1-Methylnaphthalene											**0.13 J**	0.046 U	0.042 U	**5.4 =**	0.044 U	0.045 U	**0.084 J**	0.049 U	**0.16 J**	0.047 U
2-Chlorophenol											0.049 U	0.053 U	0.049 U	0.056 U	0.052 U	0.053 U	**0.33 J**	0.057 U	0.057 U	0.055 U
2-Methylnaphthalene											**0.19 J**	0.046 U	0.042 U	**12 =**	0.044 U	0.045 U	**0.18 J**	0.049 U	**0.26 J**	0.047 U
2-Methylphenol (o-cresol)											0.048 U	0.052 U	0.048 U	**5 =**	0.05 U	0.052 U	**0.44 =**	0.056 U	0.056 U	**0.087 J**
3 & 4 Methylphenol											0.049 U	0.053 U	0.049 U	**4 =**	0.052 U	0.053 U	**0.4 J**	0.057 U	0.057 U	**0.24 J**
4-Methylphenol (p-cresol)																				
Acenaphthene											0.042 U	0.046 U	0.042 U	**2.2 =**	0.044 U	0.045 U	0.045 U	0.049 U	**0.091 J**	0.047 U
Acenaphthylene[2]											**0.11 J**	0.049 U	0.046 U	**0.46 =**	0.048 U	0.049 U	0.049 U	0.053 U	**0.06 J**	0.051 U
Anthracene											**0.18 J**	0.062 U	0.057 U	**9.2 =**	0.06 U	0.062 U	**0.16 J**	0.067 U	**0.29 J**	0.065 U
Benzo(a)anthracene											**0.96 =**	0.048 U	0.045 U	**12 =**	**0.082 J**	0.048 U	**0.61 =**	0.052 U	**0.89 =**	0.05 U
Benzo(a)pyrene											**0.94 =**	0.046 U	0.042 U	**10 =**	0.044 U	0.045 U	**0.57 =**	0.049 U	**0.94 =**	0.047 U
Benzo(b)fluoranthene											**1.7 =**	0.065 U	0.06 U	**14 =**	0.063 U	0.064 U	**0.93 =**	0.069 U	**1.6 =**	0.067 U
Benzo(g,h,i)perylene[2]											**0.68 =**	0.049 U	0.046 U	**4.6 =**	0.048 U	0.049 U	**0.3 J**	0.053 U	**0.59 =**	0.051 U
Benzo(k)fluoranthene											**0.5 =**	0.046 U	0.042 U	**4.2 =**	0.044 U	0.045 U	**0.32 J**	0.049 U	**0.49 =**	0.047 U
Bis(2-ethylhexyl)phthalate											0.043 U	0.047 U	0.043 U	0.049 U	0.046 U	0.046 U	0.047 U	0.05 U	0.051 U	0.049 U
Carbazole											**0.068 J**	0.047 U	0.043 U	**12 =**	0.046 U	0.046 U	0.047 U	0.05 U	**0.15 J**	0.049 U
Chrysene											**0.97 =**	0.044 U	0.041 U	**10 =**	**0.084 J**	0.044 U	**0.56 =**	0.048 U	**0.95 =**	0.046 U
Dibenzo(a,h)anthracene											**0.24 J**	0.044 U	0.041 U	**1.8 =**	0.043 U	0.044 U	0.044 U	0.048 U	**0.2 J**	0.046 U
Dibenzofuran											**0.09 J**	0.063 U	0.059 U	**8.2 =**	0.062 U	0.063 U	**0.093 J**	0.068 U	**0.16 J**	0.066 U
Diethylphthalate											0.046 U	0.049 U	**0.12 J**	0.052 U	0.048 U	**0.13 J**	**0.1 J**	**0.12 J**	0.053 U	0.051 U
Fluoranthene											**1.9 =**	0.059 U	0.055 U	**33 =**	**0.18 J**	0.059 U	**1.3 =**	0.064 U	**1.8 =**	0.062 U
Fluorene											**0.22 J**	0.061 U	0.056 U	**16 =**	0.059 U	0.06 U	**0.21 J**	0.065 U	**0.19 J**	0.063 U
Indeno(1,2,3-cd)pyrene											**0.54 =**	0.046 U	0.042 U	**3.7 =**	0.044 U	0.045 U	**0.23 J**	0.049 U	**0.38 J**	0.047 U
Naphthalene											**0.76 =**	0.046 U	0.042 U	**39 =**	0.044 U	**0.11 J**	**5.6 =**	0.049 U	**1.5 =**	0.047 U
Phenanthrene[2]											**1 =**	0.057 U	0.053 U	**44 =**	**0.27 J**	0.057 U	**0.92 =**	0.061 U	**1 =**	0.059 U
Phenol											**0.33 J**	0.046 U	0.042 U	**4.7 =**	0.044 U	**0.1 J**	**1.2 =**	0.049 U	**3.1 =**	**0.15 J**
Pyrene											**1.5 =**	0.058 U	0.054 U	**21 =**	**0.14 J**	0.058 U	**0.94 =**	0.063 U	**2 =**	0.061 U
Antimony, Total																				
Arsenic, Total																				
Barium, Total																				
Beryllium, Total																				
Cadmium, Total																				
Chromium, Total																				
Copper, Total																				
Lead, Total																				
Nickel, Total																				
Selenium, Total																				
Thallium, Total																				
Zinc, Total																				
Cyanide, Total																				

results are in mg/kg or ppm
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)
Yellow Highlighted and bolded font exceeds Groundwater Protection Standard Soil Screening Levels (GWPS SSL)

Table A-2
SMA 4, Subsurface Soil 2 - 15 ft, - ERP Coke

Chemical Name	CM-SB0010 (12-14 ft) 15-Jan-08		CM-SB0010 (5-7 ft) 15-Jan-08		CM-SB0010 (9-11 ft) 15-Jan-08		CM-SB0011 (10-12 ft) 16-Jan-08		CM-SB0011 (2-4 ft) 16-Jan-08		CM-SB0011 (6-8 ft) 16-Jan-08		CM-SB0012 (2-4 ft) 18-Jan-08		CM-SB0012 (8-10 ft) 18-Jan-08		CM-SB0013 (2-4 ft) 16-Jan-08		CM-SB0013 (6-8 ft) 16-Jan-08		CM-SB0015 (2-4 ft) 15-Jan-08		CM-SB0015 (6-8 ft) 15-Jan-08		CM-SB0015 (9-11 ft) 15-Jan-08		CM-SB0016 (2-4 f) 18-Jan-08		CM-SB0016 (4-6 ft) 18-Jan-08		CM-SB0017 (2-4) 16-Jan-08		CM-SB0017 (8-10 ft) 16-Jan-08		CM-SB0018 (2-4) 16-Jan-08		CM-SB0018 (7-9 ft) 16-Jan-08		CM-SB0019 (2-4 ft) 15-Jan-08		CM-SB0019 (6-8 ft) 15-Jan-08	
1,1,2-Trichloroethane	0.06	U	0.31	U	0.056	U	0.062	U	0.3	U	0.0012	U	0.069	U	0.065	U	0.23	U	0.071	U	0.0015	UJ	0.13	U	0.057	U	0.06	UJ	0.0014	UJ	64	U	0.056	U	76	U	0.065	U	5.6	U	2.4	U
1,2,4-Trichlorobenzene	0.056	U	0.053	U	0.054	U	0.055	U	0.31	U	0.055	U	0.059	U	0.056	U	0.051	U	0.057	U	0.051	U	0.056	U	0.054	U	0.048	U	0.056	U	0.054	U	0.054	U	0.058	U	0.058	U	0.05	U	0.055	U
1,2-Dichloroethane	0.1	U	0.52	U	0.093	U	0.1	U	0.51	U	0.0019	U	0.11	U	0.11	U	0.39	U	0.12	U	0.0025	UJ	0.22	U	0.094	U	0.1	UJ	0.0023	UJ	110	U	0.094	U	130	U	0.11	U	9.3	U	4	U
1,2-Dichloropropane	0.06	U	0.31	U	0.056	U	0.062	U	0.3	U	0.0012	U	0.069	U	0.065	U	0.23	U	0.071	U	0.0015	UJ	0.13	U	0.057	U	0.06	UJ	0.0014	UJ	64	U	0.056	U	76	U	0.065	U	5.6	U	2.4	U
1,4-Dichlorobenzene	0.047	U	0.044	U	0.045	U	0.046	U	0.26	U	0.046	U	0.049	U	0.047	U	0.043	U	0.048	U	0.043	U	0.047	U	0.045	U	0.04	U	0.046	U	**0.29**	J	0.045	U	0.048	U	0.049	U	**0.18**	J	0.046	U
2-Butanone (MEK)	0.55	U	2.9	U	0.51	U	0.57	U	2.8	U	0.011	U	0.63	U	0.6	U	2.1	U	0.65	U	0.013	UJ	1.2	U	0.52	U	0.55	UJ	0.013	UJ	580	U	0.52	U	700	U	0.6	U	51	U	22	U
Acetone	**0.62**	J	**2**	J	0.24	U	0.27	U	1.3	U	**0.016**	J	**0.86**	J	**0.31**	J	0.98	U	0.3	U	**0.021**	J	0.56	U	0.24	U	0.25	UJ	**0.024**	J	270	U	0.24	U	320	U	**7.6**	=	24	U	10	U
Benzene	**1.5**	=	**0.75**	J	**0.37**	=	0.057	U	**6**	=	**0.0063**	=	0.063	U	0.06	U	**1.1**	=	**1.5**	=	**0.027**	J	**3.5**	=	**6.9**	=	**0.17**	J	0.0013	UJ	230	J	**10**	=			**32**	=	**140**	=	**12**	=
Carbon disulfide	0.039	U	0.2	U	0.036	U	0.041	U	0.2	U	0.00075	U	0.045	U	0.042	U	0.15	U	0.046	U	**0.0026**	J	0.085	U	0.037	U	0.039	UJ	**0.017**	J	41	U	0.037	U	49	U	0.042	U	3.6	U	1.6	U
Carbon tetrachloride	0.07	U	0.37	U	0.065	U	0.073	U	0.35	U	0.0014	U	0.08	U	0.076	U	0.27	U	0.083	U	0.0017	UJ	0.15	U	0.066	U	0.07	UJ	0.0016	UJ	74	U	0.066	U	89	U	0.076	U	6.5	U	2.8	U
Chlorobenzene	**36**	=	**92**	=	**8.3**	=	0.057	U	**0.54**	J	0.0011	U	0.063	U	**0.51**	=	**51**	=	**200**	=	**0.0024**	J	**18**	=	**4.4**	=	0.055	UJ	0.0013	UJ	**89**	J	0.052	U	**180**	J	**2.4**	=	**75**	=	**33**	=
Chloroethane	0.075	U	0.39	U	0.07	U	0.078	U	0.38	U	0.0015	U	0.086	U	0.081	U	0.29	U	0.089	U	0.0018	UJ	0.16	U	0.071	U	0.075	UJ	0.0017	UJ	79	U	0.07	U	95	U	0.082	U	6.9	U	3	U
Chloroform	0.041	U	0.21	U	0.038	U	0.043	U	0.21	U	0.00079	U	0.047	U	0.044	U	0.16	U	0.049	U	0.001	UJ	0.09	U	0.039	U	0.041	UJ	0.00095	UJ	43	U	0.038	U	52	U	0.045	U	3.8	U	1.7	U
cis-1,2-Dichloroethene	0.048	U	0.25	U	0.045	U	0.05	U	0.24	U	0.00093	U	0.055	U	**0.13**	J	0.18	U	0.057	U	0.0012	UJ	0.11	U	0.045	U	0.048	UJ	0.0011	UJ	51	U	0.045	U	61	U	0.052	U	4.4	U	1.9	U
cis-1,3-Dichloropropene	0.05	U	0.26	U	0.047	U	0.052	U	0.25	U	0.00097	U	0.057	U	0.054	U	0.19	U	0.059	U	0.0012	UJ	0.11	U	0.047	U	0.05	UJ	0.0012	UJ	53	U	0.047	U	63	U	0.054	U	4.6	U	2	U
Ethylbenzene	0.09	U	**2**	=	**0.2**	J	0.094	U	**2.1**	=	**0.0052**	=	0.1	U	0.097	U	**0.76**	J	**0.32**	=	0.0022	UJ	0.2	U	0.085	U	0.09	UJ	0.0021	UJ	95	U	0.084	U	110	U	0.098	U	**23**	J	3.6	U
m- and p-Xylenes	**0.14**	J	**7**	=	**0.84**	=	0.038	U	**4.4**	=	0.00072	U	0.042	U	0.04	U	**1.5**	J	**1.4**	=	0.00091	UJ	**0.18**	J	**0.31**	J	**0.14**	J	0.00086	UJ	**54**	J	0.035	U	**120**	J	**0.58**	=	**99**	=	**5.6**	J
Methylene chloride	0.08	U	0.42	U	0.075	U	0.083	U	**1.9**	=	0.0015	U	**0.15**	J	**0.16**	J	0.31	U	0.095	U	0.002	UJ	0.18	U	0.076	U	0.08	UJ	0.0019	UJ	85	U	0.075	U	100	U	0.087	U	**8.6**	J	3.2	U
o-Xylene	**0.12**	J	**11**	=	**1.2**	=	0.031	U	**1.7**	=	0.00058	U	0.034	U	0.032	U	**2.4**	=	**3.4**	=	0.00074	UJ	0.066	U	**0.11**	J	**0.057**	J	0.0007	UJ	**1000**	=	0.028	U	**1400**	=	**0.92**	=	**130**	=	**14**	=
Styrene	0.031	U	0.16	U	0.028	U	0.032	U	0.15	U	0.00059	U	0.035	U	0.033	U	0.12	U	0.036	U	0.00075	UJ	0.067	U	0.029	U	0.03	UJ	0.00071	UJ	32	U	0.029	U	39	U	0.033	U	2.8	U	1.2	U
Tetrachloroethene	0.045	U	0.23	U	0.042	U	0.047	U	0.23	U	0.00087	U	0.052	U	0.049	U	0.17	U	0.053	U	0.0011	UJ	0.099	U	0.043	U	0.045	UJ	0.001	UJ	48	U	0.042	U	57	U	0.049	U	4.2	U	1.8	U
Toluene	**1.8**	=	**4.8**	=	**0.25**	=	0.052	U	**44**	=	0.00097	U	**0.62**	=	**0.14**	J	**1.3**	=	**44**	=	**0.016**	J	**1.4**	=	**66**	=	**0.26**	J	0.0012	UJ	**12000**	=	0.047	U	**56000**	=	**63**	=	**11000**	=	**360**	=
trans-1,2-Dichloroethene	0.05	U	0.26	U	0.046	U	0.051	U	0.25	U	0.00096	U	0.057	U	0.054	U	0.19	U	0.059	U	0.0012	UJ	0.11	U	0.047	U	0.049	UJ	0.0012	UJ	52	U	0.046	U	63	U	0.054	U	4.6	U	2	U
trans-1,3-Dichloropropene	0.049	U	0.25	U	0.045	U	0.05	U	0.24	U	0.00094	U	0.056	U	0.053	U	0.19	U	0.057	U	0.0012	UJ	0.11	U	0.046	U	0.048	UJ	0.0011	UJ	51	U	0.045	U	61	U	0.053	U	4.5	U	2	U
Trichloroethene	0.045	U	0.23	U	0.042	U	0.047	U	0.23	U	0.00087	U	0.052	U	0.049	U	0.17	U	0.053	U	0.0011	UJ	0.099	U	0.043	U	0.045	UJ	0.001	UJ	48	U	0.042	U	57	U	0.049	U	4.2	U	1.8	U
Vinyl chloride	0.08	U	0.42	U	0.075	U	0.083	UJ	0.4	U	0.0015	U	0.092	U	0.087	U	0.31	U	0.095	U	0.002	UJ	0.18	U	0.076	U	0.08	UJ	0.0019	UJ	85	U	0.075	U	100	U	0.087	U	7.4	U	3.2	U
Xylenes	**0.26**	J	**18**	=	**2**	=	0.068	U	**6.1**	=	0.0013	U					**3.9**	=	**4.8**	=	0.0016	UJ	**0.22**	J	**0.42**	J	**0.19**	J	0.0015	UJ	**1100**	=	0.061	U	**1500**	=	**1.5**	=	**230**	=	**20**	J
1-Methylnaphthalene	0.048	U	0.045	U	0.046	U	0.048	U	**0.58**	J	0.047	U	0.051	U	0.048	U	0.044	U	0.049	U	0.044	U	0.048	U	0.046	U	**0.11**	J	0.048	U	**0.084**	J	0.046	U	**0.82**	=	0.05	U	**1.1**	=	0.047	U
2-Chlorophenol	0.056	U	**0.12**	J	0.054	U	0.055	U	0.31	U	0.055	U	0.059	U	0.056	U	**0.41**	=	**3.4**	=	0.051	U	0.056	U	0.054	U	0.048	U	0.056	U	0.054	U	0.054	U	0.058	U	0.058	U	0.05	U	0.055	U
2-Methylnaphthalene	0.048	U	0.045	U	0.046	U	0.048	U	**0.62**	J	0.047	U	0.051	U	0.048	U	0.044	U	0.049	U	0.044	U	0.048	U	0.046	U	**0.22**	J	0.048	U	**0.13**	J	0.046	U	**1.4**	=	0.05	U	**1.6**	=	0.047	U
2-Methylphenol (o-cresol)	**0.11**	J	0.052	U	0.052	U	0.054	U	0.3	U	0.054	U	0.058	U	0.055	U	0.05	U	**0.71**	=	0.05	U	0.055	U	**0.44**	=	0.047	U	0.054	U	**3.2**	=	**0.13**	J	**1.2**	=	**0.77**	=	**2.3**	=	**0.64**	=
3 & 4 Methylphenol	**0.31**	J	0.053	U	0.054	U	0.055	U	0.31	U	**0.22**	J	0.059	U	0.056	U	0.051	U	**0.6**	=	0.051	U	**0.16**	J	**0.43**	=	0.048	U	0.056	U	**0.13**	J	**0.42**	J	**0.57**	=	**1**	=	**1.6**	=	**0.66**	=
4-Methylphenol (p-cresol)																																								
Acenaphthene	0.048	U	0.045	U	0.046	U	0.048	U	0.26	U	0.047	U	**0.16**	J	0.048	U	0.044	U	0.049	U	0.044	U	0.048	U	0.046	U	0.041	U	0.048	U	0.047	U	0.046	U	**0.49**	=	0.05	U	**0.42**	=	0.047	U
Acenaphthylene[2]	0.052	U	0.049	U	0.05	U	0.052	U	0.29	U	0.051	U	**0.38**	J	0.052	U	0.048	U	0.053	U	0.048	U	0.052	U	0.05	U	**0.11**	J	0.052	U	0.051	U	0.05	U	**0.89**	=	0.054	U	0.046	U	0.051	U
Anthracene	0.065	U	0.062	U	0.063	U	0.065	U	0.36	U	0.064	U	**1.3**	=	0.065	U	0.06	U	0.067	U	0.06	U	0.065	U	0.063	U	**0.25**	J	0.065	U	**0.15**	J	0.063	U	**3.2**	=	0.068	U	**0.6**	=	0.064	U
Benzo(a)anthracene	0.051	U	0.048	U	0.049	U	0.05	U	**1.4**	J	0.05	U	**4.7**	=	0.051	U	0.046	U	0.052	U	0.047	U	0.051	U	0.049	U	**1.8**	=	0.05	U	**0.15**	J	0.049	U	**5.2**	=	0.053	U	**0.76**	=	0.05	U
Benzo(a)pyrene	0.048	U	0.045	U	0.046	U	0.048	U	**2.2**	J	0.047	U	**5.1**	=	0.048	U	0.044	U	0.049	U	0.044	U	0.048	U	0.046	U	**2.4**	=	0.048	U	**0.12**	J	0.046	U	**4.7**	=	0.05	U	**0.79**	=	0.047	U
Benzo(b)fluoranthene	0.068	U	0.064	U	0.065	U	0.067	U	**3.4**	=	0.067	U	**6.6**	=	0.068	U	0.062	U	0.07	U	0.063	U	0.068	U	0.065	U	**3.8**	=	0.068	U	**0.13**	J	0.065	U	**7.5**	=	0.071	U	**1.1**	=	0.067	U
Benzo(g,h,i)perylene[2]	0.052	U	0.049	U	0.05	U	0.052	U	**2.3**	J	0.051	U	**2.8**	=	0.052	U	0.048	U	0.053	U	0.048	U	0.052	U	0.05	U	**3.1**	=	0.052	U	0.051	U	0.05	U	**3.4**	=	0.054	U	**0.34**	J	0.051	U
Benzo(k)fluoranthene	0.048	U	0.045	U	0.046	U	0.048	U	**1.1**	J	0.047	U	**2.8**	=	0.048	U	0.044	U	0.049	U	0.044	U	0.048	U	0.046	U	**1**	=	0.048	U	**0.1**	J	0.046	U	**2.7**	=	0.05	U	**0.38**	J	0.047	U
Bis(2-ethylhexyl)phthalate	0.049	U	0.047	U	0.047	U	0.049	U	0.27	U	0.049	U	0.052	U	0.049	U	0.045	U	0.05	U	0.045	U	0.049	U	0.047	U	**0.11**	J	0.049	U	0.048	U	0.047	U	0.051	U	0.051	U	0.044	U	0.048	U
Carbazole	0.049	U	0.047	U	0.047	U	0.049	U	0.27	U	0.049	U	**0.34**	J	0.049	U	0.045	U	0.05	U	0.045	U	0.049	U	0.047	U	**0.25**	J	0.049	U	0.048	U	0.047	U	**3.7**	=	0.051	U	**0.34**	J	0.048	U
Chrysene	0.047	U	0.044	U	0.045	U	0.046	U	**1.8**	J	0.046	U	**4.2**	=	0.047	U	0.043	U	0.048	U	0.043	U	0.047	U	0.045	U	**2.6**	=	0.046	U	**0.23**	J	0.045	U	**4.5**	=	0.049	U	**0.77**	=	0.046	U
Dibenzo(a,h)anthracene	0.047	U	0.044	U	0.045	U	0.046	U	**0.61**	J	0.046	U	**0.97**	=	0.047	U	0.043	U	0.048	U	0.043	U	0.047	U	0.045	U	**0.85**	=	0.046	U	0.045	U	0.045	U	**1**	=	0.049	U	**0.12**	J	0.046	U
Dibenzofuran	0.067	U	0.063	U	0.064	U	0.066	U	0.37	U	0.066	U	**0.19**	J	0.067	U	0.061	U	0.068	U	0.061	U	0.067	U	0.064	U	0.058	U	0.066	U	0.065	U	0.064	U	**1.6**	=	0.07	U	**0.71**	=	0.065	U
Diethylphthalate	0.052	U	**0.12**	J	**0.11**	J	0.052	U	0.29	U	0.051	U	0.055	U	0.052	U	0.048	U	0.053	U	0.048	U	**0.09**	J	**0.083**	J	0.045	U	0.052	U	0.051	U	0.05	U	0.054	U	0.054	U	**0.072**	J	**0.077**	J
Fluoranthene	0.063	U	0.059	U	0.06	U	0.062	U	**1.2**	J	0.062	U	**9.6**	=	0.063	U	0.057	U	0.064	U	0.058	U	0.063	U	0.06	U	**2.1**	=	0.062	U	**0.6**	=	0.06	U	**12**	=	0.065	U	**2**	=	0.062	U
Fluorene	0.064	U	0.061	U	0.061	U	0.063	U	0.35	U	0.063	U	**0.72**	=	0.064	U	0.058	U	0.065	U	0.059	U	0.064	U	0.062	U	**0.17**	J	0.064	U	0.062	U	0.061	U	**3.3**	=	0.067	U	**0.86**	=	0.063	U
Indeno(1,2,3-cd)pyrene	0.048	U	0.045	U	0.046	U	0.048	U	**1.8**	J	0.047	U	**2.3**	=	0.048	U	0.044	U	0.049	U	0.044	U	0.048	U	0.046	U	**2.7**	=	0.048	U	0.047	U	0.046	U	**2.5**	=	0.05	U	**0.23**	J	0.047	U
Naphthalene	0.048	U	0.045	U	0.046	U	**0.12**	J	**8.3**	=	**0.071**	J	**0.37**	J	0.048	U	**0.15**	J	**1.5**	=	0.044	U	0.048	U	0.046	U	**1.2**	=	0.048	U	**2.1**	=	0.046	U	**12**	=	**0.57**	=	**2.8**	=	0.047	U
Phenanthrene[2]	0.06	U	0.057	U	0.058	U	0.059	U	**0.73**	J	0.059	U	**5.1**	=	0.06	U	0.055	U	0.061	U	0.055	U	0.06	U	0.058	U	**1**	=	0.06	U	**0.75**	=	0.058	U	**11**	=	0.063	U	**3.2**	=	0.059	U
Phenol	**0.54**	=	**1.5**	=	0.046	U	0.048	U	**3.4**	=	**0.12**	J	0.051	U	**0.19**	J	**0.093**	J	**0.71**	=	**0.16**	J	0.048	U	**0.58**	=	**0.75**	=	0.048	U	**0.75**	=	**51**	=	0.05	U	**19**	=	**14**	=	**59**	=
Pyrene	0.061	U	0.058	U	0.059	U	0.061	U	**1.2**	J	0.06	U	**7.9**	=	0.061	U	0.056	U	0.063	U	0.056	U	0.061	U	0.059	U	**2.1**	=	0.061	U	**0.5**	=	0.059	U	**10**	=	0.064	U	**1.6**	=	0.06	U
Antimony, Total																																								
Arsenic, Total																																								
Barium, Total																																								
Beryllium, Total																																								
Cadmium, Total																																								
Chromium, Total																																								
Copper, Total																																								
Lead, Total																																								
Nickel, Total																																								
Selenium, Total																																								
Thallium, Total																																								
Zinc, Total																																								
Cyanide, Total																																								

results are in mg/kg or ppm
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)
Yellow Highlighted and bolded font exceeds Groundwater Protection Standard Soil Screening Levels (GWPS SSL)

Table A-2
SMA 4, Subsurface Soil 2 - 15 ft, - ERP Coke

Chemical Name	CM-SB0019 (9-11 ft) 15-Jan-08	CM-SB0020 (2-4 ft) 18-Jan-08	CM-SB0020 (4-6 ft) 18-Jan-08	CM-SB0021 (12-14 ft) 18-Jan-08	CM-SB0021 (2-4 ft) 18-Jan-08	CM-SB0021 (6-8 ft) 18-Jan-08	CM-SB0022 (2-4 ft) 15-Jan-08	CM-SB0022 (5-7 ft) 15-Jan-08	CM-SB0023 (2-4 ft) 15-Jan-08	CM-SB0024 (12-14 ft) 18-Jan-08	CM-SB0024 (2-4 ft) 18-Jan-08	CM-SB0024 (6-8 fr) 18-Jan-08	CM-SB0025 (17-19 ft) 17-Jan-08	CM-SB0025 (2-4 ft) 17-Jan-08	CM-SB0025 (9-11 ft) 17-Jan-08	CM-SB0026 (2-4 ft) 16-Jan-08	CM-SB0026 (7-9 ft) 16-Jan-08	CM-SB0027 (16-18 ft) 14-Jan-08	CM-SB0027 (2-4 ft) 14-Jan-08	CM-SB0027 (8-10 ft) 14-Jan-08
1,1,2-Trichloroethane	1.4 U	0.079 UJ	0.06 UJ	0.58 U	0.062 UJ	0.05 UJ	0.97 U	0.4 U	0.056 U	0.056 U	13 UJ	0.23 U	0.56 U	12 U	0.053 U	0.061 U	0.063 U	0.064 U	2.7 U	5 U
1,2,4-Trichlorobenzene	0.059 U	0.057 U	0.053 U	0.054 U	0.051 U	0.049 U	0.05 U	0.056 U	0.021 U	0.054 U	0.052 UJ	0.05 U	0.052 UJ	0.25 UJ	0.05 UJ	0.1 U	0.058 U	0.057 U	0.043 U	0.049 U
1,2-Dichloroethane	2.3 U	0.13 UJ	0.1 UJ	0.97 U	0.1 UJ	0.084 UJ	1.6 U	0.66 U	0.093 U	0.094 U	22 UJ	0.39 U	0.94 U	20 U	0.088 U	0.1 U	0.11 U	0.11 U	4.5 U	8.4 U
1,2-Dichloropropane	1.4 U	0.079 UJ	0.06 UJ	0.58 U	0.062 UJ	0.05 UJ	0.97 U	0.4 U	0.056 U	0.056 U	13 UJ	0.23 U	0.56 U	12 U	0.053 U	0.061 U	0.063 U	0.064 U	2.7 U	5 U
1,4-Dichlorobenzene	0.049 U	0.047 U	**0.31 J**	0.045 U	0.043 U	0.041 U	0.042 U	0.046 U	0.018 U	0.045 U	0.043 UJ	0.042 U	0.044 UJ	0.21 UJ	0.042 UJ	0.087 U	0.049 U	0.048 U	0.036 U	0.041 U
2-Butanone (MEK)	13 U	0.73 UJ	0.55 UJ	5.3 U	0.57 UJ	0.46 U	8.9 U	3.7 U	0.51 U	0.52 U	120 UJ	**2.6 J**	**6.3 J**	110 U	0.49 U	0.56 U	0.58 U	0.58 U	25 U	46 U
Acetone	6 U	0.34 U	0.26 UJ	2.5 U	**0.72 J**	0.21 UJ	4.1 U	1.7 U	0.24 U	**0.26 J**	**55 J**	**1.7 J**	**3.6 J**	52 U	0.23 U	0.26 U	0.27 U	0.27 UJ	11 U	21 UJ
Benzene	17 =	0.073 UJ	**0.058 J**	5.2 =	**17 J**	0.046 UJ	**2.7 J**	62 =	0.5 =	46 =	1400 J	29 =	73 =	200 =	9.7 =	0.4 =	7.4 =	46 =	160 =	95 J
Carbon disulfide	0.92 U	0.052 UJ	0.039 UJ	0.38 U	0.04 UJ	0.033 UJ	0.63 U	0.26 U	0.036 U	0.037 U	8.4 UJ	0.15 U	0.37 U	7.9 U	0.034 U	**0.066 J**	0.041 U	0.041 U	1.7 U	3.3 U
Carbon tetrachloride	1.6 U	0.093 UJ	0.07 UJ	0.68 U	0.072 UJ	0.059 UJ	1.1 U	0.46 U	0.065 U	0.066 U	15 UJ	0.27 U	0.66 U	14 U	0.062 U	0.071 U	0.074 U	0.074 U	3.1 UJ	5.9 U
Chlorobenzene	**46 =**	0.073 UJ	**0.23 J**	**0.65 J**	**9.2 J**	**0.83 J**	0.89 U	**3.2 =**	**0.9 =**	**12 =**	**28 J**	**4.5 =**	**1.2 J**	**59 =**	**1.1 =**	0.056 U	**3.4 =**	**1.9 J**	**66 J**	**36 J**
Chloroethane	1.8 U	0.099 UJ	0.076 UJ	0.73 U	0.077 UJ	0.063 UJ	1.2 U	0.5 U	0.07 U	0.07 U	16 UJ	0.29 U	0.7 U	15 U	0.066 U	0.076 U	0.079 U	0.08 U	3.3 U	6.3 U
Chloroform	0.96 U	0.054 UJ	0.041 UJ	0.4 U	0.042 UJ	0.034 UJ	0.67 U	0.27 U	0.038 U	0.039 U	8.8 UJ	0.16 U	0.38 U	8.3 U	0.036 U	0.041 U	0.043 U	0.043 UJ	1.8 UJ	3.4 UJ
cis-1,2-Dichloroethene	1.1 U	0.063 UJ	0.048 UJ	0.46 U	0.05 UJ	0.04 UJ	0.78 U	0.32 U	0.045 U	**0.083 J**	10 UJ	0.19 U	0.45 U	9.8 U	0.042 U	0.049 U	0.051 U	0.051 U	2.1 U	4 U
cis-1,3-Dichloropropene	1.2 U	0.066 UJ	0.05 UJ	0.48 U	0.052 UJ	0.042 UJ	0.81 U	0.33 U	0.046 U	0.047 U	11 UJ	0.2 U	0.47 U	10 U	0.044 U	0.051 U	0.053 U	0.053 U	2.2 U	4.2 U
Ethylbenzene	2.1 U	0.12 UJ	0.091 UJ	0.87 U	**0.86 J**	0.076 UJ	1.5 U	0.6 U	0.083 U	0.085 U	19 UJ	0.35 U	0.84 U	18 U	0.08 U	0.091 U	0.095 U	0.095 U	**29 =**	**15 J**
m- and p-Xylenes	**3 J**	**0.15 J**	0.037 UJ	0.36 U	**8.6 J**	0.031 UJ	0.6 U	0.25 U	0.034 U	0.035 U	8 UJ	**0.96 J**	0.35 U	**11 J**	**0.077 J**	**0.11 J**	0.039 U	**0.048 J**	**230 =**	**60 =**
Methylene chloride	1.9 U	0.11 UJ	0.081 UJ	0.77 U	**0.11 J**	0.067 UJ	1.3 U	0.53 U	0.074 U	**0.14 J**	17 UJ	0.31 U	6.6 =	130 =	0.71 =	0.081 U	0.084 U	0.66 =	**5.7 J**	43 =
o-Xylene	**8.4 =**	**0.054 J**	0.03 UJ	**4.9 =**	**27 J**	**0.027 J**	0.49 U	**1.4 J**	0.028 U	**0.11 J**	**37 J**	**19 =**	0.28 U	**100 =**	**0.029 J**	**0.036 J**	**0.17 J**	**0.052 J**	**220 =**	**200 =**
Styrene	0.72 U	0.04 UJ	0.031 UJ	0.3 U	**0.9 J**	0.026 U	0.49 U	0.2 U	0.028 U	0.029 U	6.6 UJ	0.12 U	0.29 U	6.2 U	0.027 U	0.031 U	0.032 U	0.032 UJ	1.4 UJ	2.6 UJ
Tetrachloroethene	1.1 U	0.059 UJ	0.045 UJ	0.44 U	0.046 UJ	0.038 UJ	0.73 U	0.3 U	0.042 U	0.042 U	9.7 UJ	0.18 U	0.42 U	9.2 U	0.04 U	0.046 U	0.047 U	0.048 UJ	2 UJ	3.8 UJ
Toluene	310 =	**4.6 J**	0.05 UJ	97 =	**68 J**	**0.067 J**	**2.5 J**	**25 =**	**0.79 =**	**0.84 =**	**1300 J**	970 =	**1.3 J**	1200 =	**0.25 =**	**0.69 =**	**13 =**	**0.42 =**	600 =	740 =
trans-1,2-Dichloroethene	1.2 U	0.065 UJ	0.05 UJ	0.48 U	0.051 UJ	0.042 UJ	0.8 U	0.33 U	0.046 U	0.047 U	11 UJ	0.19 U	0.46 U	10 U	0.044 U	0.05 U	0.052 U	0.052 U	2.2 U	4.2 U
trans-1,3-Dichloropropene	1.1 U	0.064 UJ	0.049 UJ	0.47 U	0.05 UJ	0.041 U	0.79 U	0.32 U	0.045 U	0.046 U	10 UJ	0.19 U	0.45 U	9.9 U	0.043 U	0.049 U	0.051 U	0.051 U	2.2 U	4.1 U
Trichloroethene	1.1 U	0.059 UJ	0.045 UJ	0.44 U	0.046 UJ	0.038 UJ	0.73 U	0.3 U	0.042 U	0.042 U	9.7 UJ	**0.3 J**	0.42 UJ	9.2 UJ	0.04 UJ	0.046 U	0.047 U	0.048 UJ	2 UJ	3.8 UJ
Vinyl chloride	1.9 U	0.11 UJ	0.081 UJ	0.77 U	0.083 UJ	0.067 UJ	1.3 U	0.53 U	0.074 U	0.075 U	17 UJ	0.31 U	0.75 U	16 U	0.071 U	0.081 U	0.084 U	0.085 U	3.6 U	6.7 U
Xylenes	**11 J**	**0.2 J**	0.065 UJ	**5.2 J**	**72 J**	0.055 UJ	1.1 U	**1.4 J**	0.06 U	**0.14 J**	**42 J**	**20 J**	0.61 U	**110 =**	**0.11 J**	**0.15 J**	**0.19 J**	**0.1 J**	**450 =**	**260 =**
1-Methylnaphthalene	0.05 U	0.049 U	**0.12 J**	0.046 U	**0.1 J**	0.042 U	**0.051 J**	0.048 U	**0.55 =**	**0.046 U**	**0.4 J**	0.043 U	0.045 UJ	0.22 UJ	0.043 UJ	**0.51 J**	0.05 U	0.049 U	**0.097 J**	**0.13 J**
2-Chlorophenol	0.059 U	0.057 U	0.053 U	0.054 U	0.051 U	0.049 U	0.05 U	0.056 U	0.021 U	0.054 U	0.052 U	0.05 U	0.052 U	0.25 U	0.05 U	0.1 U	0.058 U	0.057 U	0.043 U	0.049 U
2-Methylnaphthalene	0.05 U	**0.12 J**	**0.25 J**	0.046 U	**0.14 J**	0.042 U	**0.089 J**	0.048 U	**0.66 =**	0.046 U	**0.75 J**	0.043 U	0.045 UJ	**0.67 J**	0.043 UJ	**0.5 J**	0.05 U	0.049 U	**0.16 J**	**0.23 J**
2-Methylphenol (o-cresol)	**1 =**	0.055 U	0.052 U	**0.79 =**	**0.24 J**	0.048 U	0.049 U	0.054 U	0.021 U	0.053 U	**0.37 J**	**0.17 J**	0.051 U	**1.6 J**	0.049 U	0.1 U	0.057 U	0.056 U	0.042 U	**0.82 =**
3 & 4 Methylphenol	0.89 =	0.057 U	0.053 U	1.2 =	**0.23 J**	0.049 U	0.05 U	**0.23 J**	**0.049 J**	0.054 U	0.59 =	1.1 =	0.052 U	**0.98 J**	**0.17 J**	0.1 U	0.058 U	0.057 U	0.043 U	0.74 =
4-Methylphenol (p-cresol)																				
Acenaphthene	0.05 U	0.049 U	0.046 U	0.046 U	**0.19 J**	0.042 U	0.043 U	0.048 U	**0.17 =**	0.046 U	**0.88 J**	0.043 U	0.045 UJ	0.22 UJ	0.043 UJ	**0.4 J**	0.05 U	0.049 U	**0.057 J**	**0.11 J**
Acenaphthylene[2]	0.054 U	0.053 U	0.05 U	0.05 U	**0.092 J**	0.045 U	0.047 U	0.052 U	**0.21 =**	0.05 U	**3.3 J**	0.047 U	0.048 UJ	0.23 UJ	0.046 UJ	**1.7 =**	0.054 U	0.053 U	0.04 U	**0.058 J**
Anthracene	0.068 U	**0.19 J**	**0.3 J**	0.063 U	**0.32 J**	0.057 U	**0.089 J**	0.065 U	**0.28 =**	0.063 U	**21 J**	0.059 U	0.061 UJ	**0.62 J**	0.058 UJ	**4.3 =**	0.068 U	0.067 U	**0.14 J**	**0.47 =**
Benzo(a)anthracene	0.053 U	1.3 =	2 =	0.049 U	**0.71 =**	0.044 U	**0.49 =**	0.05 U	**0.55 =**	0.049 U	**30 J**	0.046 U	0.047 UJ	**2.4 J**	0.045 UJ	11 =	0.053 U	0.052 U	**0.27 J**	**0.76 =**
Benzo(a)pyrene	0.05 U	**1.3 =**	**2.2 =**	0.046 U	**0.82 =**	0.042 U	**0.47 =**	0.048 U	**0.74 =**	0.046 U	**20 J**	0.043 U	0.045 UJ	0.22 UJ	0.043 UJ	**15 =**	0.05 U	0.049 U	**0.22 J**	**0.68 =**
Benzo(b)fluoranthene	**0.12 J**	2.8 =	3.4 =	0.066 U	**1.5 =**	0.059 U	**0.88 =**	0.068 U	**1.2 =**	0.066 U	**30 J**	0.061 U	0.063 UJ	0.31 UJ	0.061 UJ	19 =	0.071 U	0.07 U	**0.31 J**	**0.96 =**
Benzo(g,h,i)perylene[2]	0.054 U	**1.2 =**	**2.9 =**	0.05 U	**0.66 =**	0.045 U	**0.35 J**	0.052 U	**0.56 =**	0.05 U	**14 J**	0.047 U	0.048 UJ	**1.7 J**	0.046 UJ	**9.7 =**	0.054 U	0.053 U	**0.13 J**	**0.34 J**
Benzo(k)fluoranthene	0.05 U	**0.78 =**	**0.96 =**	0.046 U	**0.65 =**	0.042 U	**0.35 J**	0.048 U	**0.29 =**	0.046 U	**12 J**	0.043 U	0.045 UJ	0.22 UJ	0.043 UJ	**6.5 =**	0.05 U	0.049 U	**0.11 J**	**0.34 J**
Bis(2-ethylhexyl)phthalate	0.052 U	0.05 U	**0.13 J**	0.048 U	0.045 U	0.043 U	0.044 U	0.049 U	0.019 U	0.048 U	0.046 UJ	0.044 U	0.046 UJ	0.22 UJ	0.044 UJ	0.092 U	0.051 U	0.051 U	0.038 U	0.044 U
Carbazole	0.052 U	**0.16 J**	**0.3 J**	0.048 U	**0.2 J**	0.043 U	0.044 U	0.049 U	0.35 =	0.048 U	**1.6 J**	**0.12 J**	0.046 UJ	0.22 UJ	0.044 UJ	1.8 =	0.051 U	0.051 U	0.038 U	**0.21 J**
Chrysene	0.049 U	**2 =**	**2.3 =**	0.045 U	**0.73 =**	0.041 U	**0.67 =**	0.046 U	**0.57 =**	0.045 U	**29 J**	0.042 U	0.044 UJ	**2.2 J**	0.042 UJ	**11 =**	0.049 U	0.048 U	**0.25 J**	**0.7 =**
Dibenzo(a,h)anthracene	0.049 U	**0.54 =**	**0.88 =**	0.045 U	**0.17 J**	0.041 U	**0.14 J**	0.046 U	**0.2 =**	0.045 U	**4.7 =**	0.042 U	0.044 UJ	0.21 UJ	0.042 UJ	**3 =**	0.049 U	0.048 U	0.036 U	**0.064 J**
Dibenzofuran	0.07 U	0.068 U	**0.11 J**	0.065 U	**0.32 J**	0.058 U	0.06 U	0.066 U	0.34 =	0.065 U	**3.6 J**	0.06 U	0.062 UJ	0.3 UJ	0.06 UJ	0.9 =	0.07 U	0.068 U	**0.094 J**	**0.3 J**
Diethylphthalate	**0.13 J**	0.053 U	0.05 U	0.05 U	0.047 U	0.045 U	0.047 U	**0.099 J**	0.02 U	0.05 U	0.048 UJ	0.047 U	0.048 UJ	0.23 UJ	0.046 UJ	0.097 U	0.054 U	0.053 U	0.04 U	**0.28 J**
Fluoranthene	**0.14 J**	**1.9 =**	**2.1 =**	0.061 U	**1.7 =**	0.055 U	**0.77 =**	0.062 U	**1.1 =**	0.061 U	**70 =**	**0.19 J**	0.058 UJ	**4.1 J**	0.056 UJ	**23 =**	0.065 U	0.064 U	**0.55 =**	**2 =**
Fluorene	0.067 U	0.065 U	**0.24 J**	0.062 U	**0.45 =**	0.056 U	0.058 U	0.064 U	**0.66 =**	0.062 U	**12 J**	0.058 U	0.06 UJ	**0.91 J**	0.057 UJ	**2.5 =**	0.067 U	0.066 U	**0.19 J**	**0.64 =**
Indeno(1,2,3-cd)pyrene	0.05 U	**1.2 =**	**2.4 =**	0.046 U	**0.36 J**	0.042 U	**0.24 J**	0.048 U	**0.32 =**	0.046 U	**14 J**	0.043 U	0.045 UJ	**1.3 J**	0.043 UJ	**8.5 =**	0.05 U	0.049 U	**0.081 J**	**0.29 J**
Naphthalene	**0.15 J**	**0.22 J**	1.3 =	0.046 U	0.6 =	0.042 U	**0.15 J**	0.048 U	0.87 =	0.046 U	**0.74 J**	**0.11 J**	**0.19 J**	**10 J**	0.043 UJ	2.3 =	**0.063 J**	0.049 U	0.39 =	0.83 =
Phenanthrene[2]	**0.2 J**	**1.1 =**	**1.3 =**	0.058 U	**1.7 =**	0.052 U	**0.34 J**	0.06 U	**0.54 =**	0.058 U	**58 =**	**0.32 J**	0.056 UJ	**3.4 J**	0.054 UJ	**13 =**	0.063 U	0.062 U	**0.77 =**	**2.4 =**
Phenol	**64 =**	0.049 U	**0.86 =**	**2 =**	**0.28 J**	0.042 U	**1.5 =**	**1.2 =**	**0.18 =**	0.046 U	**1.5 =**	0.043 U	**0.33 J**	**0.9 J**	**0.23 J**	**4.3 =**	0.05 U	**0.41 J**	0.037 U	**0.36 J**
Pyrene	**0.14 J**	**1.7 =**	**2.4 =**	0.059 U	**1.5 =**	0.054 U	**0.77 =**	0.061 U	**1 =**	0.059 U	**53 =**	**0.15 J**	0.057 UJ	**4.1 J**	0.055 UJ	**19 =**	0.064 U	0.063 U	**0.57 =**	**1.5 =**
Antimony, Total																				
Arsenic, Total																				
Barium, Total																				
Beryllium, Total																				
Cadmium, Total																				
Chromium, Total																				
Copper, Total																				
Lead, Total																				
Nickel, Total																				
Selenium, Total																				
Thallium, Total																				
Zinc, Total																				
Cyanide, Total																				

results are in mg/kg or ppm
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)
Yellow Highlighted and bolded font exceeds Groundwater Protection Standard Soil Screening Levels (GWPS SSL)

Table A-2
SMA 4, Subsurface Soil 2 - 15 ft, - ERP Coke

Chemical Name	CM-SB0028 (10-12 ft) 14-Jan-08	CM-SB0028 (7-9 ft) 14-Jan-08	CM-SB0029 (2-4 ft) 17-Jan-08	CM-SB0029 (7-9 ft) 17-Jan-08	CM-SB0030 (2-4 ft) 18-Jan-08	CM-SB0030 (5-7 ft) 18-Jan-08	CM-SB0030 (7-9 ft) 18-Jan-08	CM-SB0031 (17-19 ft) 18-Jan-08	CM-SB0031 (2-4 ft) 18-Jan-08	CM-SB0031 (6-8 ft) 18-Jan-08	CM-SB0032 (2-4 ft) 14-Jan-08	CM-SB0032 (7-9) 14-Jan-08	CM-SB0033 (12-14 ft) 14-Jan-08	CM-SB0033 (8-10 ft) 14-Jan-08	CM-SB0033 (2-4 ft) 14-Jan-08	CM-SB0034 (14-16 ft) 18-Jan-08	CM-SB0034 (2-4 ft) 18-Jan-08	CM-SB0034 (6-8 ft) 18-Jan-08	CM-SB0035 (14-16 ft) 14-Jan-08	CM-SB0035 (2-4 ft) 14-Jan-08
1,1,2-Trichloroethane	0.0011 U	0.066 U	1.3 U	0.082 U	0.25 UJ	28 UJ	0.063 U	0.0011 UJ	0.11 U	0.001 UJ	4.2 U	0.07 U	0.058 U	0.0013 U	4.6 U	0.001 UJ	0.33 U	0.053 UJ	0.071 U	1.9 U
1,2,4-Trichlorobenzene	0.051 U	0.053 U	0.26 U	0.058 U	0.051 U	0.051 U	0.056 U	0.051 U	0.055 U	0.02 U	0.054 U	0.057 U	0.052 U	0.052 U	0.054 U	0.019 U	0.055 U	0.05 U	0.059 U	0.54 U
1,2-Dichloroethane	0.0019 U	0.11 U	2.1 U	0.14 U	**1.1 J**	47 UJ	0.11 U	0.0019 UJ	0.19 U	0.0017 UJ	7 U	0.12 U	0.097 U	0.0022 U	7.6 U	0.0017 UJ	0.55 U	0.088 UJ	0.12 U	3.2 U
1,2-Dichloropropane	0.0011 U	0.066 U	1.3 U	0.082 U	0.25 UJ	28 UJ	0.063 U	0.0011 UJ	0.11 U	0.001 UJ	4.2 U	0.07 U	0.058 U	0.0013 U	4.6 U	0.001 UJ	0.33 U	0.053 UJ	0.071 U	1.9 U
1,4-Dichlorobenzene	0.042 U	0.044 U	0.22 U	0.048 U	0.042 U	0.042 U	0.046 U	0.042 U	0.046 U	0.017 U	0.045 U	0.048 U	0.043 U	0.043 U	0.045 U	**0.026 J**	0.046 U	0.042 U	0.049 U	0.45 U
2-Butanone (MEK)	0.01 U	0.6 U	11 U	0.75 U	2.3 UJ	260 UJ	0.58 U	0.01 UJ	**1.2 J**	0.0093 UJ	38 U	0.64 U	0.53 U	0.012 U	42 U	0.0093 UJ	3 U	0.48 UJ	0.65 U	17 U
Acetone	0.0047 U	0.28 UJ	5.3 U	**0.7 J**	1.1 UJ	120 UJ	**7.7 =**	**0.022 J**	**3.9 J**	**0.021 J**	18 U	0.3 UJ	0.25 UJ	**0.014 J**	19 U	**0.033 J**	**3.1 J**	0.22 UJ	0.3 U	8.1 U
Benzene	**0.014 =**	**0.72 J**	130 =	3.3 =	**0.44 J**	250 J	15 =	0.001 UJ	1.8 =	**0.0073 J**	55 =	**1.1 J**	**3.5 J**	**0.0056 =**	760 =	0.00093 UJ	**7.4 J**	0.048 UJ	3.1 =	84 =
Carbon disulfide	**0.00074 J**	0.043 U	0.81 U	0.053 U	0.16 UJ	18 UJ	0.041 U	0.00073 UJ	**0.16 J**	**0.00089 J**	2.7 U	0.046 U	0.038 U	0.00085 U	3 U	0.00066 UJ	0.22 U	0.034 UJ	0.046 U	1.2 U
Carbon tetrachloride	0.0013 UJ	0.077 U	1.5 U	0.096 U	0.3 UJ	33 UJ	0.074 U	0.0013 UJ	0.13 U	0.0012 UJ	4.9 UJ	0.082 U	0.068 U	0.0015 U	5.4 U	0.0012 UJ	0.39 U	0.062 UJ	0.083 UJ	2.2 U
Chlorobenzene	**0.053 J**	**0.087 J**	1.1 U	0.075 U	**39 J**	**170 J**	**3.2 =**	**0.056 J**	0.1 U	**0.0021 J**	**11 J**	**9.7 =**	**0.054 J**	**0.03 =**	4.2 U	**0.032 J**	**61 J**	**2.6 J**	**7.6 J**	**34 =**
Chloroethane	0.0014 U	0.082 U	1.6 U	0.1 U	0.32 UJ	35 UJ	0.079 U	0.0014 UJ	0.14 U	0.0013 UJ	5.2 U	0.088 U	0.073 U	0.0016 U	5.7 U	0.0013 UJ	0.41 U	0.066 UJ	0.089 U	2.4 U
Chloroform	0.00076 UJ	0.045 UJ	0.86 U	0.056 U	0.17 UJ	19 UJ	0.043 U	0.00077 UJ	0.076 U	0.00069 UJ	2.9 UJ	0.048 UJ	0.04 UJ	0.00089 U	3.1 U	0.00069 UJ	0.23 U	0.036 UJ	0.049 UJ	1.3 U
cis-1,2-Dichloroethene	0.00089 U	0.053 U	1 U	0.066 U	0.2 UJ	23 UJ	0.05 U	0.0009 UJ	0.089 U	0.00081 UJ	3.3 U	0.056 U	0.047 U	0.001 U	3.7 U	0.00081 UJ	0.26 U	0.042 UJ	0.057 U	1.5 U
cis-1,3-Dichloropropene	0.00093 U	0.055 U	1 U	0.068 UJ	0.21 UJ	24 UJ	0.053 U	0.00094 UJ	0.093 U	0.00084 UJ	3.5 U	0.058 U	0.048 U	0.0011 U	3.8 U	0.00085 UJ	0.28 U	0.044 UJ	0.059 U	1.6 U
Ethylbenzene	0.0017 U	0.099 U	**4.8 J**	0.12 U	0.38 UJ	43 UJ	**0.25 J**	0.0017 UJ	0.17 U	0.0015 UJ	**340 =**	**2.2 =**	0.087 U	0.002 U	6.9 U	0.0015 UJ	**1.9 J**	0.079 UJ	0.11 U	**460 =**
m- and p-Xylenes	0.00069 U	**0.048 J**	**13 =**	0.051 UJ	**0.28 J**	**74 J**	**0.83 =**	0.00069 UJ	**0.42 J**	**0.003 J**	2100 =	**0.34 J**	0.036 U	0.0008 UB	**9.3 J**	0.00063 UJ	**19 J**	0.033 UJ	**0.067 J**	**1900 =**
Methylene chloride	0.0015 U	0.088 U	12 =	**0.18 J**	0.34 UJ	38 UJ	0.084 U	0.0015 UJ	0.15 U	0.0014 UJ	**9 J**	0.093 U	0.63 =	0.0017 U	6.1 U	0.0014 UJ	**0.51 J**	0.07 UJ	**0.13 J**	2.5 U
o-Xylene	0.00056 U	0.033 U	0.63 U	0.041 U	**0.41 J**	**330 J**	**2.1 =**	0.00056 UJ	**0.13 J**	**0.0017 J**	**570 =**	**0.073 J**	0.029 U	0.00065 UB	5.9 J	**0.00069 J**	**3.1 J**	0.026 UJ	0.036 U	**490 =**
Styrene	0.00057 UJ	0.033 UJ	0.64 U	0.042 U	0.13 UJ	14 UJ	0.032 U	0.00057 UJ	0.057 U	0.00052 UJ	2.1 UJ	0.036 UJ	0.03 UJ	0.00066 U	2.3 U	0.00052 UJ	0.17 U	0.027 UJ	0.036 UJ	0.97 U
Tetrachloroethene	0.00084 UJ	0.049 UJ	0.94 U	0.061 U	0.19 UJ	21 UJ	0.047 U	0.00084 UJ	0.084 U	0.00076 UJ	3.1 UJ	0.053 UJ	0.044 UJ	0.00098 U	3.4 U	0.00076 UJ	0.25 U	0.04 UJ	0.053 UJ	1.4 U
Toluene	0.00093 U	0.055 U	**1.9 J**	0.068 U	**45 J**	**5800 J**	**31 J**	**0.0023 J**	**1.7 =**	**0.018 J**	330 =	0.058 U	0.048 U	0.0011 U	**27 =**	**0.0017 J**	**29 J**	**0.07 J**	0.059 U	820 =
trans-1,2-Dichloroethene	0.00092 U	0.054 U	1 U	0.068 U	0.21 UJ	23 UJ	0.052 U	0.00093 UJ	0.092 U	0.00084 UJ	3.5 U	0.058 U	0.048 U	0.0011 U	3.8 U	0.00084 UJ	0.27 U	0.044 UJ	0.059 U	1.6 U
trans-1,3-Dichloropropene	0.0009 U	0.053 U	1 U	0.066 UJ	0.2 UJ	23 UJ	0.051 U	0.00091 UJ	0.09 U	0.00082 UJ	3.4 U	0.057 U	0.047 U	0.0011 U	3.7 U	0.00082 UJ	0.27 U	0.043 UJ	0.057 U	1.5 U
Trichloroethene	0.00084 UJ	0.049 UJ	0.94 UJ	0.061 UJ	0.19 UJ	21 UJ	0.047 U	0.00084 UJ	0.084 U	0.00076 UJ	3.1 UJ	0.053 UJ	0.044 UJ	0.00098 U	3.4 U	0.00076 UJ	0.25 U	0.04 UJ	0.053 UJ	1.4 U
Vinyl chloride	0.0015 U	0.088 U	1.7 U	0.11 U	0.34 UJ	38 UJ	0.084 U	0.0015 UJ	0.15 U	0.0014 UJ	5.6 U	0.093 U	0.078 U	**0.0042 J**	6.1 U	0.0014 UJ	0.44 U	0.07 UJ	0.095 U	2.5 U
Xylenes	0.0012 U	0.071 U	**14 =**	0.089 U	**0.69 J**	**410 J**	**2.9 J**	0.0012 UJ	**0.55 J**	**0.0047 J**	**2500 =**	**0.42 J**	0.063 U	0.0014 UB	**15 J**	0.0011 UJ	**22 J**	0.057 UJ	**0.082 J**	**2400 =**
1-Methylnaphthalene	0.043 U	0.046 U	**1.5 J**	0.049 U	1.5 =	**0.14 J**	0.048 U	0.044 U	0.047 U	0.017 U	**0.2 J**	0.049 U	0.044 U	0.045 U	**0.057 J**	0.017 U	0.047 U	0.043 U	0.05 U	46 =
2-Chlorophenol	0.051 U	0.053 U	0.26 U	0.058 U	0.051 U	0.051 U	0.056 U	0.051 U	0.055 U	0.02 U	0.054 U	0.057 U	0.052 U	0.052 U	0.054 U	0.019 U	0.055 U	0.05 U	0.059 U	0.54 U
2-Methylnaphthalene	0.043 U	0.046 U	**2 J**	0.049 U	**1.3 =**	**0.24 J**	0.048 U	0.044 U	0.047 U	0.017 U	**0.4 J**	0.049 U	0.044 U	0.045 U	**0.09 J**	0.017 U	0.047 U	0.043 U	0.05 U	**110 =**
2-Methylphenol (o-cresol)	0.049 U	0.052 U	0.25 U	0.056 U	**0.33 J**	**3.3 =**	**0.22 J**	0.05 U	0.054 U	0.02 U	0.052 U	0.056 U	0.05 U	0.051 U	0.053 U	0.019 U	0.054 U	0.049 U	0.057 U	0.52 U
3 & 4 Methylphenol	0.051 U	0.053 U	0.26 U	0.058 U	0.051 U	3.3 =	**0.14 J**	0.051 U	0.055 U	0.02 U	0.054 U	0.057 U	0.052 U	0.052 U	0.054 U	0.019 U	0.055 U	0.05 U	0.059 U	0.54 U
4-Methylphenol (p-cresol)																				
Acenaphthene	0.043 U	0.046 U	**3.9 =**	0.049 U	**0.2 J**	**0.14 J**	0.048 U	0.044 U	0.047 U	0.017 U	**0.2 J**	0.049 U	0.044 U	0.045 U	0.046 U	0.017 U	0.047 U	0.043 U	0.05 U	**94 =**
Acenaphthylene[2]	0.047 U	0.049 U	**2.7 =**	0.054 U	**0.3 J**	0.047 U	0.052 U	0.047 U	0.051 U	0.019 U	**0.094 J**	0.053 U	0.048 U	0.048 U	0.05 U	0.018 U	**0.1 J**	0.047 U	0.055 U	**4.6 =**
Anthracene	0.059 U	0.062 U	**20 =**	0.067 U	**0.43 =**	**0.32 J**	0.065 U	0.059 U	0.065 U	0.024 U	**0.91 =**	0.067 U	0.06 U	0.061 U	**0.19 J**	0.023 U	**0.14 J**	**0.19 J**	0.068 U	**140 =**
Benzo(a)anthracene	0.046 U	**0.16 J**	39 =	0.052 U	1.6 =	**0.41 =**	0.05 U	0.046 U	**0.082 J**	0.018 U	1.3 =	0.052 U	0.047 U	0.047 U	**1.3 =**	0.018 U	**0.41 J**	1.8 =	0.053 U	40 =
Benzo(a)pyrene	0.043 U	**0.26 J**	29 =	0.049 U	**2.1 =**	**0.37 J**	0.048 U	0.044 U	0.047 U	0.017 U	**1.3 =**	0.049 U	0.044 U	0.045 U	**1.2 =**	0.017 U	**0.46 =**	**1.7 =**	0.05 U	21 =
Benzo(b)fluoranthene	0.061 U	**0.4 J**	43 =	0.07 U	4.3 =	**0.57 =**	0.067 U	0.062 U	**0.12 J**	0.025 U	2.4 =	0.07 U	0.063 U	0.063 U	**1.8 =**	0.024 U	**0.89 =**	2.6 =	0.071 U	34 =
Benzo(g,h,i)perylene[2]	0.047 U	**0.17 J**	**14 =**	0.054 U	**1.3 =**	**0.14 J**	0.052 U	0.047 U	0.051 U	0.019 U	**0.83 =**	0.053 U	0.048 U	0.048 U	**0.6 =**	**0.1 J**	**0.24 J**	**1.3 =**	0.055 U	**7 =**
Benzo(k)fluoranthene	0.043 U	**0.1 J**	**16 =**	0.049 U	**1.6 =**	**0.17 J**	0.048 U	0.044 U	0.047 U	0.017 U	**0.65 =**	0.049 U	0.044 U	0.045 U	**0.52 =**	0.017 U	**0.32 J**	**0.73 =**	0.05 U	**11 =**
Bis(2-ethylhexyl)phthalate	0.045 U	0.047 U	0.23 U	0.051 U	**0.13 J**	0.045 U	0.049 U	0.045 U	0.049 U	0.018 U	0.047 U	0.051 U	0.045 U	0.046 U	0.048 U	0.017 U	0.048 U	**0.22 J**	0.052 U	0.47 U
Carbazole	0.045 U	**0.057 J**	5.5 =	0.051 U	**0.15 J**	**0.15 J**	0.049 U	0.045 U	0.049 U	0.018 U	**0.21 J**	0.051 U	0.045 U	0.046 U	**0.094 J**	0.017 U	0.048 U	**0.21 J**	0.052 U	44 =
Chrysene	0.042 U	**0.18 J**	**31 =**	0.048 U	**2.3 =**	**0.41 =**	0.046 U	0.042 U	**0.094 J**	0.017 U	**1.3 =**	0.048 U	0.043 U	0.043 U	**1.3 =**	0.016 U	**0.48 =**	**2 =**	0.049 U	**36 =**
Dibenzo(a,h)anthracene	0.042 U	**0.058 J**	0.22 U	0.048 U	**0.53 =**	**0.044 J**	0.046 U	0.042 U	0.046 U	0.017 U	**0.19 J**	0.048 U	0.043 U	0.043 U	**0.29 J**	0.016 U	**0.11 J**	**0.53 =**	0.049 U	**2.5 J**
Dibenzofuran	0.06 U	0.063 U	4.2 =	0.069 U	0.58 =	**0.24 J**	0.066 U	0.061 U	0.066 U	0.024 U	**0.38 J**	0.068 U	0.061 U	0.062 U	0.065 U	0.023 U	0.065 U	0.06 U	0.07 U	99 =
Diethylphthalate	0.047 U	0.049 U	0.24 U	0.054 U	0.047 U	0.047 U	0.052 U	0.047 U	0.051 U	0.019 U	0.05 U	0.053 U	0.048 U	0.048 U	0.05 U	0.018 U	0.051 U	0.047 U	0.055 U	0.5 U
Fluoranthene	0.057 U	**0.33 J**	**50 =**	0.065 U	**2 =**	**1.2 =**	0.062 U	0.057 U	**0.2 J**	0.023 U	**3.3 =**	0.064 U	0.058 U	0.058 U	**1.2 =**	0.022 U	**0.99 =**	**2.4 =**	0.066 U	**220 =**
Fluorene	0.058 U	**0.11 J**	**13 =**	0.066 U	**0.19 J**	**0.49 =**	0.064 U	0.058 U	0.063 U	0.023 U	**0.93 =**	0.066 U	0.059 U	0.059 U	**0.074 J**	0.022 U	0.063 U	0.057 U	0.067 U	**170 =**
Indeno(1,2,3-cd)pyrene	0.043 U	**0.13 J**	**10 J**	0.049 UJ	**0.92 =**	**0.11 J**	0.048 U	0.044 U	0.047 U	0.017 U	**0.66 =**	0.049 U	0.044 U	0.045 U	**0.43 =**	**0.11 J**	**0.24 J**	**1.2 =**	0.05 U	**5.5 =**
Naphthalene	0.043 U	0.046 U	6 =	0.049 U	1.3 =	0.92 =	0.048 U	0.044 U	**0.19 J**	0.017 U	1.8 =	**0.06 J**	0.044 U	0.045 U	**0.33 J**	0.017 U	0.65 =	**0.16 J**	**0.23 J**	490 =
Phenanthrene[2]	0.054 U	**0.28 J**	**53 =**	0.062 U	**1.9 =**	**1.5 =**	0.06 U	0.055 U	**0.1 J**	0.022 U	**4.1 =**	0.062 U	0.055 U	0.056 U	**0.68 =**	0.021 U	**0.53 =**	**0.81 =**	**0.14 J**	**440 =**
Phenol	0.043 U	0.046 U	**0.82 J**	**0.61 =**	**1 =**	**0.82 =**	**0.24 J**	**0.055 J**	0.047 U	**0.048 J**	0.046 U	0.049 U	0.044 U	0.045 U	**0.13 J**	0.017 U	0.047 U	0.043 U	0.05 U	0.46 U
Pyrene	0.055 U	**0.27 J**	**58 J**	0.063 UJ	**2 =**	**0.95 =**	0.061 U	0.056 U	**0.18 J**	0.022 U	**3 =**	0.063 U	0.057 U	0.057 U	**1.1 =**	0.021 U	**0.64 =**	**2.2 =**	0.064 U	**160 =**
Antimony, Total																				
Arsenic, Total																				
Barium, Total																				
Beryllium, Total																				
Cadmium, Total																				
Chromium, Total																				
Copper, Total																				
Lead, Total																				
Nickel, Total																				
Selenium, Total																				
Thallium, Total																				
Zinc, Total																				
Cyanide, Total																				

results are in mg/kg or ppm
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)
Yellow Highlighted and bolded font exceeds Groundwater Protection Standard Soil Screening Levels (GWPS SSL)

Table A-2
SMA 4, Subsurface Soil 2 - 15 ft, - ERP Coke

Chemical Name	CM-SB0035 (6-8 ft) 14-Jan-08		CM-SB0036 (2-4 ft) 18-Jan-08		CM-SB0036 (6-8 ft) 18-Jan-08		CM-SB0036 (9-11 ft) 18-Jan-08		CM-SB0037 (2-4) (2-4 ft) 17-Jan-08		CM-SB0037 (8-10 ft) 17-Jan-08		CM-SB0038 (2-4 ft) 18-Jan-08		CM-SB0038 (5-7 ft) 18-Jan-08		CM-SB0039 (2-4 ft) 17-Jan-08		CM-SB0039 (7-9 ft) 17-Jan-08		CM-SB0040 (2-4 ft) 17-Jan-08		CM-SB0040 (6-8 ft) 17-Jan-08		CM-SB0040 (8-10 ft) 17-Jan-08		CM-SB0041 (2-4 ft) 17-Jan-08		CM-SB0041 (6-8 ft) 17-Jan-08		CM-SB0042 (2-4 ft) 17-Jan-08		CM-SB0042 (6-8 ft) 17-Jan-08		CM-SB0043 (2-4 ft) 17-Jan-08		CM-SB0043 (5-7 ft) 17-Jan-08	
1,1,2-Trichloroethane	0.069	U	0.0015	UJ	0.0013	UJ	0.0013	UJ	0.0012	UJ	0.0014	U	0.0016	UJ	0.061	U	0.067	U	0.0013	UJ	0.046	U	0.0013	UJ	0.0013	UJ	0.001	UJ	0.0013	UJ	0.00092	UJ	0.0014	UJ	0.0013	UJ	0.0015	UJ
1,2,4-Trichlorobenzene	0.057	U	0.049	U	0.023	UJ	0.057	U	0.051	UJ	0.058	UJ	0.055	U	0.055	U	0.051	U	0.058	UJ	0.049	U	0.057	U	0.058	U	0.048	UJ	0.055	UJ	0.048	U	0.058	UJ	0.048	U	0.058	UJ
1,2-Dichloroethane	0.12	U	0.0026	UJ	0.0022	UJ	0.0021	UJ	0.002	UJ	0.0023	U	0.0027	UJ	0.1	U	0.11	U	0.0022	UJ	0.077	U	0.0021	UJ	0.0022	UJ	0.0017	UJ	0.0022	UJ	0.0015	UJ	0.0024	UJ	0.0021	UJ	0.0024	UJ
1,2-Dichloropropane	0.069	U	0.0015	UJ	0.0013	UJ	0.0013	UJ	0.0012	UJ	0.0014	U	0.0016	UJ	0.061	U	0.067	U	0.0013	UJ	**1.3**	=	0.0013	UJ	0.0013	UJ	0.001	UJ	0.0013	UJ	0.00092	UJ	0.0014	UJ	0.0013	UJ	0.0015	UJ
1,4-Dichlorobenzene	0.048	U	0.041	U	0.019	UJ	0.048	U	0.042	UJ	0.048	UJ	0.046	U	0.046	U	0.043	U	0.048	UJ	0.041	U	0.047	U	0.048	U	0.04	UJ	0.046	UJ	0.04	U	0.048	UJ	0.04	U	0.049	UJ
2-Butanone (MEK)	0.63	U	0.014	UJ	0.012	UJ	0.012	UJ	0.011	UJ	0.013	UJ	0.015	UJ	0.55	U	0.61	U	0.012	UJ	0.42	U	0.012	UJ	0.012	UJ	0.0095	UJ	0.012	UJ	0.0085	UJ	0.013	UJ	0.012	UJ	0.013	UJ
Acetone	0.29	UJ	**0.022**	J	**0.007**	J	**0.024**	J	**0.034**	JJ	0.0058	UB	**0.032**	J	**0.43**	J	**0.45**	J	0.0055	UJ	**0.28**	J	0.0054	UJ	0.0056	UJ	0.0044	UJ	0.0056	UJ	0.0039	UJ	0.0061	UJ	0.0054	UJ	0.0062	UJ
Benzene	0.063	UJ	120	J	**0.1**	J	**0.0097**	J	**0.12**	J	**0.0034**	J	**0.0015**	J	0.055	U	3.5	=	**0.0012**	J	0.53	=	**0.041**	J	**0.004**	J	0.00095	UJ	0.0012	UJ	**0.00093**	J	0.0013	UJ	**0.0024**	J	0.0013	UJ
Carbon disulfide	0.045	U	0.001	UJ	0.00085	UJ	0.00083	UJ	**0.0057**	J	**0.031**	J	**0.0013**	J	0.039	U	0.043	U	0.00084	UJ	**0.57**	=	**0.0023**	J	0.00086	UJ	**0.0066**	J	**0.0018**	J	0.0006	UJ	0.00093	UJ	**0.0013**	J	0.00095	UJ
Carbon tetrachloride	0.081	U	0.0018	UJ	0.0015	UJ	0.0015	UJ	0.0014	UJ	0.0016	U	**0.0019**	J	0.071	U	0.078	U	0.0015	UJ	**0.35**	=	0.0015	UJ	0.0016	UJ	0.0012	UJ	0.0015	UJ	0.0011	UJ	0.0017	UJ	0.0015	UJ	0.0017	UJ
Chlorobenzene	**4.1**	J	**1.7**	J	**0.0042**	J	**0.019**	J	0.0011	UJ	**0.0035**	J	0.0015	UJ	**4.2**	=	0.061	U	0.0012	UJ	0.042	U	**0.0014**	J	**0.0016**	J	0.00095	UJ	0.0012	UJ	0.00085	UJ	0.0013	UJ	0.0012	UJ	0.0013	UJ
Chloroethane	0.086	U	0.0019	UJ	0.0016	UJ	0.0016	UJ	0.0015	UJ	0.0017	U	0.002	UJ	0.076	U	0.083	U	0.0016	UJ	0.057	U	0.0016	UJ	0.0017	UJ	0.0013	UJ	0.0017	UJ	0.0012	UJ	0.0018	UJ	0.0016	UJ	0.0018	UJ
Chloroform	0.047	UJ	0.0011	UJ	0.00089	UJ	0.00088	UJ	0.00082	UJ	0.00093	U	**0.0017**	J	0.041	U	0.046	U	0.00089	UJ	0.031	U	0.00086	UJ	0.00091	UJ	0.00071	UJ	0.00091	UJ	0.00063	UJ	0.00098	UJ	0.00087	UJ	0.001	UJ
cis-1,2-Dichloroethene	0.055	U	0.0012	UJ	**0.0014**	J	**0.04**	J	0.00096	UJ	0.0011	U	0.0013	UJ	0.048	U	0.053	U	**0.0011**	J	0.037	U	0.001	UJ	0.0011	UJ	0.00083	UJ	0.0011	UJ	0.00074	UJ	0.0012	UJ	0.001	UJ	0.0012	UJ
cis-1,3-Dichloropropene	0.058	U	**0.0064**	J	0.0011	UJ	0.0011	UJ	0.001	U	0.0011	U	0.0013	UJ	0.05	U	0.056	U	0.0011	UJ	0.038	U	0.0011	UJ	0.0011	UJ	0.00086	UJ	0.0011	UJ	0.00077	UJ	0.0012	UJ	0.0011	UJ	0.0012	UJ
Ethylbenzene	0.1	U	**1.1**	J	0.002	UJ	0.0019	UJ	0.0018	UJ	0.0021	U	0.0024	UJ	0.091	U	0.1	U	0.0019	UJ	0.069	U	0.0019	UJ	0.002	UJ	0.0016	UJ	0.002	UJ	0.0014	UJ	0.0022	UJ	0.0019	UJ	0.0022	UJ
m- and p-Xylenes	**0.12**	J	**3.7**	J	**0.0089**	J	0.00079	UJ	0.00074	U	0.00084	U	**0.0025**	J	0.037	U	**0.099**	J	0.0008	UJ	0.028	U	0.00078	UJ	0.00082	UJ	**0.0015**	J	0.00082	UJ	0.00057	UJ	0.00089	UJ	0.00078	UJ	0.0009	UJ
Methylene chloride	0.092	U	0.0021	UJ	0.0017	UJ	0.0017	UJ	0.0016	UJ	0.0018	U	0.0021	UJ	**0.18**	J	**0.15**	J	0.0017	UJ	**0.11**	J	0.0017	UJ	0.0018	UJ	0.0014	UJ	0.0018	UJ	**0.0016**	J	0.0019	UJ	0.0017	UJ	0.002	UJ
o-Xylene	**0.044**	J	**1.8**	J	**0.0025**	J	0.00064	UJ	0.0006	UJ	0.00068	U	0.0008	UJ	0.03	U	**0.052**	J	0.00065	UJ	0.023	U	0.00063	UJ	0.00066	UJ	0.00052	UJ	0.00066	UJ	0.00046	UJ	0.00072	UJ	0.00063	UJ	0.00073	UJ
Styrene	0.035	UJ	**0.0064**	J	0.00067	UJ	0.00065	UJ	0.00061	UJ	0.0007	U	0.00082	UJ	0.031	U	0.034	U	0.00066	UJ	0.023	U	0.00064	UJ	0.00068	UJ	0.00053	UJ	0.00067	UJ	0.00047	UJ	0.00073	UJ	0.00064	UJ	0.00075	UJ
Tetrachloroethene	0.052	UJ	0.0012	UJ	0.00098	UJ	0.00096	UJ	0.0009	UJ	0.001	U	**0.0012**	J	0.045	U	0.05	U	0.00097	UJ	0.034	U	0.00095	UJ	0.001	UJ	0.00078	UJ	0.001	UJ	0.00069	UJ	0.0011	UJ	0.00095	UJ	0.0011	UJ
Toluene	**0.086**	J	**2.2**	J	**0.0034**	J	0.0011	UJ	0.001	UJ	0.0011	U	**0.0018**	J	0.05	U	**0.27**	J	0.0011	UJ	0.038	U	0.0011	UJ	0.0011	UJ	0.00086	UJ	0.0011	UJ	**0.002**	J	0.0012	UJ	0.0011	UJ	**0.0019**	J
trans-1,2-Dichloroethene	0.057	U	0.0013	UJ	0.0011	UJ	**0.0032**	J	0.00099	UJ	0.0011	U	**0.0021**	J	0.05	U	0.055	U	0.0011	UJ	0.038	U	0.001	UJ	0.0011	UJ	0.00085	UJ	0.0011	UJ	0.00076	UJ	0.0012	UJ	0.001	UJ	0.0012	UJ
trans-1,3-Dichloropropene	0.056	U	**0.0064**	J	0.0011	UJ	0.001	UJ	0.00097	U	0.0011	U	0.0013	UJ	0.049	U	0.054	U	0.001	UJ	0.037	U	0.001	UJ	0.0011	UJ	0.00084	UJ	0.0011	UJ	0.00075	UJ	0.0012	UJ	0.001	UJ	0.0012	UJ
Trichloroethene	0.052	UJ	0.0012	UJ	0.00098	UJ	**0.0015**	J	0.0009	UJ	0.001	UJ	**0.0014**	J	0.045	U	0.05	UJ	0.00097	UJ	0.034	UJ	0.00095	UJ	0.001	UJ	0.00078	UJ	0.001	UJ	0.00069	UJ	0.0011	UJ	0.00095	UJ	0.0011	UJ
Vinyl chloride	0.092	U	0.0021	UJ	**0.011**	J	**0.1**	J	0.0016	UJ	0.0018	U	0.0021	UJ	0.081	U	0.089	U	**0.0046**	J	0.061	U	**0.0089**	J	**0.005**	J	0.0014	UJ	0.0018	UJ	0.0012	UJ	0.0019	UJ	0.0017	UJ	0.002	UJ
Xylenes	**0.17**	J	**5.5**	J	**0.011**	J	0.0014	UJ	0.0013	UJ	0.0015	U	**0.0032**	J			**0.15**	J	0.0014	UJ	0.05	U	0.0014	UJ	0.0014	UJ	**0.0019**	J	0.0014	UJ	0.001	UJ	0.0016	UJ	0.0014	UJ	0.0016	UJ
1-Methylnaphthalene	0.049	U	0.042	U	0.019	UJ	0.049	U	**0.6**	J	0.049	UJ	**0.05**	J	0.047	U	0.044	U	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	**0.1**	J	0.05	UJ
2-Chlorophenol	0.057	U	0.049	U	0.023	UJ	0.057	U	0.051	U	0.058	U	0.055	U	0.055	U	0.051	U	0.058	U	0.049	U	0.057	U	0.058	U	0.048	U	0.055	U	0.048	U	0.058	U	0.048	U	0.058	U
2-Methylnaphthalene	0.049	U	**0.14**	J	0.019	UJ	0.049	U	**0.56**	J	0.049	UJ	**0.092**	J	0.047	U	0.044	U	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	**0.14**	J	0.05	UJ
2-Methylphenol (o-cresol)	0.056	U	0.048	U	0.022	UJ	0.056	U	0.05	U	0.056	U	0.054	U	0.054	U	0.05	U	0.057	U	0.048	U	0.056	U	0.057	U	0.047	U	0.054	U	0.047	U	0.056	U	0.047	U	0.057	U
3 & 4 Methylphenol	0.057	U	0.049	U	0.023	UJ	0.057	U	0.051	U	0.058	U	0.055	U	0.055	U	0.051	U	0.058	U	0.049	U	0.057	U	0.058	U	0.048	U	0.055	U	0.048	U	0.058	U	0.048	U	0.058	U
4-Methylphenol (p-cresol)																																						
Acenaphthene	0.049	U	0.042	U	0.019	UJ	0.049	U	**0.31**	J	0.049	U	0.047	U	0.047	U	0.044	U	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	0.041	U	0.05	UJ
Acenaphthylene[2]	0.053	U	**0.12**	J	0.021	UJ	0.053	U	**0.28**	J	0.054	U	0.051	U	0.051	U	0.048	U	0.054	UJ	0.045	U	0.053	U	0.054	U	0.045	UJ	0.051	UJ	0.045	U	0.054	UJ	0.045	U	0.054	UJ
Anthracene	0.067	U	**0.24**	J	0.026	UJ	0.067	U	**0.72**	J	0.067	U	**0.53**	=	0.064	U	0.06	U	0.068	UJ	0.057	U	0.066	U	0.068	U	0.057	UJ	0.064	UJ	0.056	U	0.067	UJ	**0.13**	J	0.068	UJ
Benzo(a)anthracene	0.052	U	2.2	=	0.02	UJ	0.052	U	2.9	J	0.052	UJ	**0.48**	=	0.05	U	**0.44**	=	0.053	UJ	0.044	U	0.052	U	0.053	U	0.044	UJ	0.05	UJ	0.044	U	0.052	UJ	**0.43**	=	0.053	UJ
Benzo(a)pyrene	0.049	U	**1.7**	=	0.019	UJ	0.049	U	0.044	UJ	0.049	UJ	0.047	U	0.047	U	**0.55**	=	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	0.041	U	0.05	UJ
Benzo(b)fluoranthene	0.07	U	2.9	=	0.027	UJ	0.069	U	0.062	UJ	0.07	UJ	0.067	U	0.067	U	**0.94**	=	0.071	UJ	0.059	U	0.069	U	0.071	U	0.059	UJ	0.067	UJ	0.058	U	0.07	UJ	**0.78**	=	0.071	UJ
Benzo(g,h,i)perylene[2]	0.053	U	**1.6**	=	**0.12**	J	0.053	U	**2.4**	J	0.054	UJ	**0.19**	J	**0.16**	J	**0.26**	J	0.054	UJ	0.045	U	0.053	U	0.054	U	0.045	UJ	0.051	UJ	0.045	U	0.054	UJ	**0.21**	J	0.054	UJ
Benzo(k)fluoranthene	0.049	U	**0.77**	=	0.019	UJ	0.049	U	0.044	UJ	0.049	UJ	0.047	U	0.047	U	**0.27**	J	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	**0.26**	J	0.05	UJ
Bis(2-ethylhexyl)phthalate	0.05	U	0.043	U	0.02	UJ	0.05	U	0.045	UJ	0.051	UJ	0.049	U	0.048	U	0.045	U	0.051	UJ	0.043	U	0.05	U	0.051	U	0.043	UJ	0.049	UJ	0.042	U	0.051	UJ	0.043	U	0.051	UJ
Carbazole	0.05	U	**0.29**	J	0.02	U	0.05	U	**0.99**	J	0.051	UJ	**0.14**	J	0.048	U	0.045	U	0.051	UJ	0.043	U	0.05	U	0.051	U	0.043	UJ	0.049	UJ	0.042	U	0.051	UJ	0.043	U	0.051	UJ
Chrysene	0.048	U	**2.4**	=	0.019	UJ	0.048	U	**3.1**	J	0.048	UJ	**0.66**	=	0.046	U	**0.48**	=	0.048	UJ	0.041	U	0.047	U	0.048	U	0.04	UJ	0.046	UJ	0.04	U	0.048	UJ	**0.58**	=	0.049	UJ
Dibenzo(a,h)anthracene	0.048	U	**0.66**	=	0.019	UJ	0.048	U	0.042	UJ	0.048	UJ	0.046	U	**0.22**	J	0.043	U	0.048	UJ	0.041	U	0.047	U	0.048	U	0.04	UJ	0.046	UJ	0.04	U	0.048	UJ	0.04	U	0.049	UJ
Dibenzofuran	0.068	U	0.058	U	0.027	U	0.068	U	**0.36**	J	0.069	UJ	**0.2**	J	0.065	U	0.061	U	0.069	UJ	0.058	U	0.068	U	0.069	U	0.058	UJ	0.066	UJ	0.057	U	0.069	UJ	0.057	U	0.069	UJ
Diethylphthalate	0.053	U	0.045	U	0.021	U	0.053	U	0.047	UJ	0.054	UJ	0.051	U	0.051	U	0.048	U	0.054	UJ	0.045	U	0.053	U	0.054	U	0.045	UJ	0.051	UJ	0.045	U	0.054	UJ	0.045	U	0.054	UJ
Fluoranthene	**0.076**	J	**3.2**	=	0.025	U	0.064	U	**4.4**	J	0.065	UJ	**1.9**	=	0.061	U	**0.48**	=	0.065	UJ	0.055	U	0.064	U	0.065	U	0.054	UJ	0.062	UJ	0.054	U	0.065	UJ	**0.64**	=	0.065	UJ
Fluorene	0.065	U	**0.11**	J	0.026	U	0.065	U	**0.91**	J	0.066	UJ	0.063	U	0.063	U	0.059	U	0.066	UJ	0.056	U	0.065	U	0.066	U	0.055	UJ	0.063	UJ	0.055	U	0.066	UJ	0.055	U	0.067	UJ
Indeno(1,2,3-cd)pyrene	0.049	U	**1.5**	=	**0.11**	J	0.049	U	**1.5**	J	0.049	UJ	**0.13**	J	**0.17**	J	**0.16**	J	0.05	UJ	0.042	UJ	0.049	UJ	0.05	UJ	0.042	UJ	0.047	UJ	0.041	UJ	0.049	UJ	**0.13**	J	0.05	UJ
Naphthalene	**0.074**	J	**0.25**	J	0.019	U	0.049	U	**2.9**	J	0.049	UJ	**0.2**	J	0.047	U	0.044	U	0.05	UJ	0.042	U	0.049	U	0.05	U	0.042	UJ	0.047	UJ	0.041	U	0.049	UJ	**0.16**	J	0.05	UJ
Phenanthrene[2]	**0.16**	J	**1.2**	=	0.024	U	0.061	U	**2.8**	J	0.062	UJ	**2**	=	0.059	U	**0.2**	J	0.062	UJ	0.052	U	0.061	U	0.062	U	0.052	UJ	0.059	UJ	0.052	U	0.062	UJ	**0.55**	=	0.063	UJ
Phenol	0.049	U	0.042	U	0.019	U	0.049	U	**0.089**	J	0.049	U	0.047	U	0.047	U	**0.36**	J	0.05	U	0.042	U	0.049	U	**0.21**	J	0.042	U	0.047	U	0.041	U	0.049	U	0.041	U	0.05	U
Pyrene	**0.063**	J	**3.1**	=	0.025	U	0.062	U	**4.7**	J	0.063	UJ	**1.2**	=	0.06	U	**0.58**	J	0.064	UJ	0.053	UJ	0.062	UJ	0.064	UJ	0.053	UJ	0.061	UJ	0.053	UJ	0.063	UJ	**0.92**	J	0.064	UJ
Antimony, Total																																						
Arsenic, Total																																						
Barium, Total																																						
Beryllium, Total																																						
Cadmium, Total																																						
Chromium, Total																																						
Copper, Total																																						
Lead, Total																																						
Nickel, Total																																						
Selenium, Total																																						
Thallium, Total																																						
Zinc, Total																																						
Cyanide, Total																																						

results are in mg/kg or ppm
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)
Yellow Highlighted and bolded font exceeds Groundwater Protection Standard Soil Screening Levels (GWPS SSL)

Table A-2
SMA 4, Subsurface Soil 2 - 15 ft, - ERP Coke

Chemical Name	CM-SB0044 (2-4 ft) 16-Jan-08		CM-SB0044 (7-9 ft) 16-Jan-08		CM-SB0045 (7-9 ft) 16-Jan-08		CM-SB0046 (14-16 ft) 18-Jan-08		CM-SB0046 (2-4 ft) 18-Jan-08		CM-SB0046 (8-10 ft) 18-Jan-08		CM-SB0047 (2-4 ft) 16-Jan-08		CM-SB0047 (6-8 ft) 16-Jan-08		CM-SB0048 (12-14 ft) 18-Jan-08		CM-SB0048 (2-4 ft) 18-Jan-08		CM-SB0048 (6-8 ft) 18-Jan-08		CM-SB0049 (2-4 ft) 16-Jan-08		CM-SB0049 (6-8 ft) 16-Jan-08		CM-SB0049 (9-11 ft) 16-Jan-08		CM-SB0050 (2-4 ft) 16-Jan-08		CM-SB0050 (6-8 ft) 16-Jan-08		CM-SB0050 (9-11 ft) 16-Jan-08		CM-SB0051 (2-4 ft) 16-Jan-08		CM-SB0051 (7-9 ft) 16-Jan-08		CM-SB0052 (2-4 ft) 16-Jan-08	
1,1,2-Trichloroethane	0.058	U	0.0013	U	0.085	U	0.0012	UJ	0.2	UJ	0.0012	UJ	0.13	UJ	0.0015	U	1.2	UJ	0.0017	UJ	0.052	UJ	0.0013	UJ	0.0013	U	0.0014	U	0.053	U	0.0011	U	0.0012	U	0.0012	U	0.0013	U	0.0014	U
1,2,4-Trichlorobenzene	0.049	U	0.058	U	0.056	UJ	0.06	U	0.058	U	0.053	U	0.25	U	0.059	U	0.054	U	0.049	U	0.05	U	0.053	U	0.058	U	0.058	U	0.047	U	0.056	U	0.056	U	0.055	U	0.057	U	0.055	U
1,2-Dichloroethane	0.097	U	0.0021	U	0.14	U	**0.0052**	**J**	0.34	UJ	0.0019	UJ	0.22	UJ	0.0024	U	2.1	UJ	0.0029	UJ	0.087	UJ	0.0021	UJ	0.0022	U	0.0023	U	0.088	U	0.0019	U	0.002	U	0.0019	U	0.0021	U	0.0024	U
1,2-Dichloropropane	0.058	U	0.0013	U	0.085	U	0.0012	UJ	0.2	UJ	0.0012	UJ	0.13	UJ	0.0015	U	1.2	UJ	0.0017	UJ	0.052	UJ	0.0013	UJ	0.0013	U	0.0014	U	0.053	U	0.0011	U	0.0012	U	0.0012	U	0.0013	U	0.0014	U
1,4-Dichlorobenzene	0.041	U	0.048	U	0.047	UJ	0.05	U	0.048	U	0.044	U	0.21	U	0.049	U	0.045	U	0.041	U	0.041	U	0.044	U	0.049	U	0.048	U	0.04	U	0.047	U	0.047	U	0.046	U	0.048	U	0.046	U
2-Butanone (MEK)	0.53	U	0.012	U	0.78	U	0.011	UJ	1.9	UJ	0.011	UJ	1.2	UJ	0.013	U	11	UJ	0.016	UJ	0.48	UJ	0.011	UJ	0.012	U	0.013	U	0.48	U	0.01	U	0.011	U	**0.024**	**J**	0.011	U	0.013	U
Acetone	0.25	U	**0.0072**	**J**	0.36	U	**0.03**	**J**	**2.5**	**J**	**0.013**	**J**	**6.9**	**J**	**0.011**	**J**	5.3	UJ	**0.015**	**J**	0.22	UJ	**0.02**	**J**	0.0055	U	0.0058	U	0.22	U	0.0048	UB	0.0051	U	**0.037**	**J**	**0.013**	**J**	0.0061	U
Benzene	**0.063**	**J**	0.0012	U	**0.31**	**J**	**0.11**	**J**	**9.4**	**J**	**0.52**	**J**	**22**	**J**	**0.0028**	**J**	**4.4**	**J**	**0.0073**	**J**	**0.12**	**J**	**0.0012**	**J**	0.0012	U	0.0013	U	**0.06**	**J**	0.18	=	0.29	=	**0.004**	**J**	**0.0046**	**J**	**0.013**	=
Carbon disulfide	0.038	U	**0.00093**	**J**	**0.062**	**J**	**0.0038**	**J**	0.13	UJ	0.00076	UJ	0.086	UJ	**0.0046**	**J**	0.81	UJ	**0.0033**	**J**	0.034	UJ	**0.003**	**J**	0.00084	U	**0.0033**	**J**	**0.07**	**J**	0.00073	U	**0.00086**	**J**	**0.0059**	=	**0.0082**	=	**0.01**	=
Carbon tetrachloride	0.068	U	0.0015	U	0.1	U	0.0015	UJ	0.24	UJ	0.0014	UJ	0.15	UJ	0.0017	U	1.5	UJ	0.002	UJ	0.061	UJ	0.0015	UJ	0.0015	U	0.0016	U	0.061	U	0.0013	U	0.0014	U	0.0014	U	0.0015	U	0.0017	U
Chlorobenzene	0.053	U	0.0012	U	**0.12**	**J**	0.0011	UJ	0.19	UJ	0.0011	UJ	0.12	UJ	0.0013	U	**18**	**J**	0.0016	UJ	**1.7**	**J**	0.0011	UJ	0.0012	U	0.0013	U	0.048	U	0.001	U	0.0011	U	0.0011	U	0.0011	U	0.0013	U
Chloroethane	0.073	U	0.0016	U	0.11	UJ	0.0016	UJ	0.25	UJ	0.0015	UJ	0.17	UJ	0.0018	U	1.6	UJ	0.0021	UJ	0.066	UJ	0.0016	UJ	0.0016	U	0.0017	U	0.066	U	0.0014	U	0.0015	U	0.0015	U	0.0016	U	0.0018	U
Chloroform	0.04	U	0.00086	U	0.058	U	0.00085	UJ	0.14	UJ	0.00079	UJ	0.091	UJ	0.001	U	0.85	UJ	0.0012	UJ	0.036	UJ	0.00085	UJ	0.00089	U	0.00094	U	0.036	U	0.00077	U	0.00082	U	0.00079	U	0.00086	U	0.00099	U
cis-1,2-Dichloroethene	0.047	U	0.001	U	**4.9**	=	0.001	UJ	0.16	UJ	0.00093	UJ	0.11	UJ	0.0012	U	1	UJ	0.0014	UJ	0.042	UJ	0.001	UJ	0.001	U	0.0011	U	0.042	U	**0.0058**	=	**0.14**	=	**0.0015**	**J**	**0.023**	**J**	0.0012	U
cis-1,3-Dichloropropene	0.049	U	0.0011	U	0.071	U	0.001	UJ	0.17	UJ	0.00097	UJ	0.11	UJ	0.0012	U	1	UJ	0.0014	UJ	0.044	UJ	0.001	UJ	0.0011	U	0.0011	U	0.044	U	0.00094	U	0.001	U	0.00097	U	0.001	U	0.0012	U
Ethylbenzene	**0.8**	=	0.0019	U	0.13	U	**0.01**	**J**	**26**	**J**	**0.0018**	**J**	**0.81**	**J**	0.0022	U	**3**	**J**	**0.0054**	**J**	0.079	UJ	0.0019	UJ	0.0019	U	0.0021	U	0.079	U	**0.014**	=	**0.0077**	=	0.0017	U	0.0019	U	0.0022	U
m- and p-Xylenes	**0.59**	=	0.00078	U	**0.12**	**J**	0.00077	UJ	**6.9**	**J**	**0.0087**	**J**	**5.4**	**J**	**0.0014**	**J**	**12**	**J**	**0.028**	**J**	0.032	UJ	**0.0032**	**J**	0.0008	U	0.00084	U	**0.12**	**J**	**0.0074**	**J**	0.00074	UB	0.00072	UB	**0.0033**	**J**	0.00089	UB
Methylene chloride	0.078	U	0.0017	U	0.11	U	0.0017	UJ	0.27	UJ	0.0015	UJ	0.18	UJ	0.0019	U	1.7	UJ	0.0023	UJ	0.07	UJ	**0.0019**	**J**	0.0017	U	0.0018	U	0.07	U	0.0015	UB	0.0016	U	0.0015	U	0.0017	U	0.0019	U
o-Xylene	**0.1**	**J**	0.00063	U	**0.048**	**J**	**0.00096**	**J**	**14**	**J**	**0.0068**	**J**	**1.1**	**J**	0.00073	U	**30**	**J**	**0.0075**	**J**	0.026	UJ	**0.0014**	**J**	0.00065	U	0.00068	U	**0.04**	**J**	**0.0077**	=	**0.0011**	**J**	**0.00072**	**J**	**0.0011**	**J**	**0.0013**	**J**
Styrene	0.03	U	0.00064	U	0.043	U	0.00063	UJ	0.1	UJ	0.00059	UJ	0.067	UJ	0.00074	U	0.63	UJ	0.00087	UJ	0.027	UJ	0.00064	UJ	0.00066	U	0.0007	U	0.027	U	**0.00086**	**J**	0.00061	U	0.00059	U	0.00064	U	0.00073	U
Tetrachloroethene	0.044	U	0.00095	U	**0.55**	=	0.00093	UJ	0.15	UJ	0.00087	UJ	0.1	UJ	0.0011	U	0.94	UJ	0.0013	UJ	0.039	UJ	0.00094	UJ	0.00097	U	0.001	U	0.039	U	0.00084	U	**0.0013**	**J**	0.00087	U	0.00094	U	0.0011	U
Toluene	**0.23**	**J**	0.0011	U	**0.28**	**J**	0.001	UJ	**0.57**	**J**	**0.002**	**J**	**6**	**J**	0.0012	UB	**240**	**J**	**0.01**	**J**	**0.057**	**J**	0.001	UJ	0.0011	U	0.0011	UB	**0.35**	=	**0.006**	=	0.001	UB	0.00097	UB	0.001	UB	0.0012	UB
trans-1,2-Dichloroethene	0.048	U	0.001	U	**0.61**	=	0.001	UJ	0.17	UJ	0.00096	UJ	0.11	UJ	0.0012	U	1	UJ	0.0014	UJ	0.043	UJ	0.001	UJ	0.0011	U	0.0011	U	0.043	U	0.00093	U	**0.0084**	=	0.00096	U	0.001	U	0.0012	U
trans-1,3-Dichloropropene	0.047	U	0.001	U	0.069	U	0.001	UJ	0.16	UJ	0.00094	UJ	0.11	UJ	0.0012	U	1	UJ	0.0014	UJ	0.042	UJ	0.001	UJ	0.001	U	0.0011	U	0.043	U	0.00091	U	0.00097	U	0.00094	U	0.001	U	0.0012	U
Trichloroethene	0.044	U	0.00095	U	**0.44**	=	0.00093	UJ	0.15	UJ	0.00087	UJ	0.1	UJ	0.0011	U	0.94	UJ	0.0013	UJ	0.039	UJ	0.00094	UJ	0.00097	U	0.001	U	0.039	U	0.00084	U	**0.0031**	**J**	0.00087	U	0.00094	U	0.0011	U
Vinyl chloride	0.078	U	0.0017	U	3.3	=	0.0017	UJ	0.27	UJ	0.0015	UJ	0.18	UJ	0.0019	U	1.7	UJ	0.0023	UJ	0.07	UJ	0.0017	UJ	0.0017	U	0.0018	U	0.07	U	**0.0044**	**J**	0.024	=	**0.0017**	**J**	0.028	=	0.0019	U
Xylenes	**0.69**	=	0.0014	U	**0.16**	**J**	0.0013	UJ	**21**	**J**	**0.015**	**J**	**6.5**	**J**	**0.002**	**J**	**42**	**J**	**0.036**	**J**	0.057	UJ	**0.0045**	**J**	0.0014	U	0.0015	U	**0.16**	**J**	**0.015**	=	**0.0031**	**J**	**0.0024**	**J**	**0.0044**	**J**	**0.0045**	**J**
1-Methylnaphthalene	**0.059**	**J**	0.049	U	**0.052**	**J**	0.051	U	0.05	U	0.045	U	47	=	0.051	U	0.046	U	0.042	U	0.043	U	0.045	U	0.05	U	0.05	U	3.1	=	0.048	U	0.048	U	**0.055**	**J**	0.049	U	**0.26**	**J**
2-Chlorophenol	0.049	U	0.058	U	0.056	UJ	0.06	U	0.058	U	0.053	U	0.25	U	0.059	U	0.054	U	0.049	U	0.05	U	0.053	U	0.058	U	0.058	U	0.047	U	0.056	U	0.056	U	0.055	U	0.057	U	0.055	U
2-Methylnaphthalene	**0.075**	**J**	0.049	U	**0.059**	**J**	0.051	U	0.05	U	0.045	U	**120**	=	0.051	U	0.046	U	0.042	U	0.043	U	0.045	U	0.05	U	0.05	U	**3.2**	=	0.048	U	0.048	U	**0.095**	**J**	0.049	U	**0.28**	**J**
2-Methylphenol (o-cresol)	0.048	U	0.056	U	0.055	UJ	0.058	U	0.057	U	0.052	U	0.24	U	0.058	U	0.052	U	0.048	U	0.048	U	0.051	U	0.057	U	0.057	U	0.046	U	0.055	U	0.055	U	0.053	U	0.056	U	0.054	U
3 & 4 Methylphenol	0.049	U	0.058	U	0.056	UJ	0.06	U	0.058	U	0.053	U	0.25	U	0.059	U	0.054	U	0.049	U	0.05	U	0.053	U	0.058	U	0.058	U	0.047	U	0.056	U	0.056	U	0.055	U	0.057	U	0.055	U
4-Methylphenol (p-cresol)																																								
Acenaphthene	**0.1**	**J**	0.049	U	**0.072**	**J**	0.051	U	0.05	U	0.045	U	**2.8**	=	0.051	U	0.046	U	0.042	U	0.043	U	0.045	U	0.05	U	0.05	U	**7.9**	=	**0.058**	**J**	0.048	U	0.047	U	0.049	U	**0.33**	**J**
Acenaphthylene[2]	**0.067**	**J**	0.054	U	**0.056**	**J**	0.056	U	0.054	U	0.049	U	**6.9**	=	0.055	U	0.05	U	0.046	U	0.046	U	0.049	U	0.054	U	0.054	U	**0.25**	**J**	0.052	U	0.052	U	0.051	U	0.053	U	**0.47**	=
Anthracene	**0.61**	=	0.067	U	**0.15**	**J**	0.07	U	0.068	U	0.062	U	**37**	=	0.069	U	0.062	U	0.058	U	0.058	U	**0.08**	**J**	0.068	U	0.068	U	**26**	=	**0.12**	**J**	**0.1**	**J**	**0.13**	**J**	0.067	U	**1.4**	=
Benzo(a)anthracene	3.1	=	0.052	U	**0.79**	**J**	0.054	U	0.053	U	0.048	U	24	=	0.054	U	0.048	U	0.045	U	0.045	U	**0.22**	**J**	0.053	U	0.052	U	110	=	**0.081**	**J**	**0.085**	**J**	**0.73**	=	0.052	U	3.9	=
Benzo(a)pyrene	**3.4**	=	0.049	U	**0.95**	**J**	0.051	U	0.05	U	0.045	U	18	=	0.051	U	**0.19**	**J**	0.042	U	0.043	U	**0.23**	**J**	0.05	U	0.05	U	98	=	0.048	U	**0.12**	**J**	**1**	=	0.049	U	**4**	=
Benzo(b)fluoranthene	6.3	=	0.07	U	**1.4**	**J**	**0.72**	=	0.071	U	0.064	U	25	=	0.072	U	**0.3**	**J**	0.06	U	0.06	U	**0.33**	**J**	0.071	U	0.07	U	130	=	0.068	U	**0.11**	**J**	**1.6**	=	0.069	U	6.9	=
Benzo(g,h,i)perylene[2]	**2.4**	=	0.054	U	**0.58**	**J**	**0.18**	**J**	0.054	U	0.049	U	**8.3**	=	0.055	U	**0.11**	**J**	0.046	U	0.046	U	**0.13**	**J**	0.054	U	0.054	U	**56**	=	0.052	U	0.052	U	**0.58**	=	0.053	U	**2.2**	=
Benzo(k)fluoranthene	**1.6**	=	0.049	U	**0.43**	**J**	**0.22**	**J**	0.05	U	0.045	U	**9.7**	=	0.051	U	**0.13**	**J**	0.042	U	0.043	U	**0.11**	**J**	0.05	U	0.05	U	**45**	=	0.048	U	0.048	U	**0.5**	=	0.049	U	**2**	=
Bis(2-ethylhexyl)phthalate	0.044	U	0.051	U	0.05	UJ	0.053	U	0.051	U	0.047	U	0.22	U	0.052	U	0.047	U	0.044	U	0.044	U	0.046	U	0.051	U	0.051	U	0.042	U	0.049	U	0.05	U	0.048	U	0.05	U	0.048	U
Carbazole	**0.37**	**J**	0.051	U	0.05	UJ	0.053	U	0.051	U	0.047	U	24	=	0.052	U	0.047	U	0.044	U	0.044	U	0.046	U	0.051	U	0.051	U	0.042	U	**0.16**	**J**	**0.11**	**J**	0.048	U	0.05	U	0.7	=
Chrysene	**3.2**	=	0.048	U	**0.87**	**J**	**0.27**	**J**	0.048	U	0.044	U	**20**	=	0.049	U	0.045	U	0.041	U	0.041	U	**0.22**	**J**	0.049	U	0.048	U	**100**	=	**0.064**	**J**	**0.12**	**J**	**0.83**	=	0.048	U	**3.9**	=
Dibenzo(a,h)anthracene	**0.96**	=	0.048	U	**0.21**	**J**	0.05	U	0.048	U	0.044	U	**4.8**	=	0.049	U	0.045	U	0.041	U	0.041	U	0.044	U	0.049	U	0.048	U	**14**	=	0.047	U	0.047	U	**0.3**	**J**	0.048	U	**0.83**	=
Dibenzofuran	**0.15**	**J**	0.069	U	0.067	UJ	0.071	U	0.069	U	0.063	U	15	=	0.07	U	0.064	U	0.059	U	0.059	U	0.063	U	0.069	U	0.069	U	**2.2**	**J**	**0.099**	**J**	0.067	U	0.065	U	0.068	U	0.49	=
Diethylphthalate	0.046	U	0.054	U	0.052	UJ	0.056	U	0.054	U	0.049	U	0.23	U	0.055	U	0.05	U	0.046	U	0.046	U	0.049	U	0.054	U	0.054	U	0.044	U	0.052	U	0.052	U	0.051	U	0.053	U	0.051	U
Fluoranthene	**4.2**	=	0.065	U	**0.83**	**J**	**0.15**	**J**	0.065	U	0.059	U	**65**	=	0.066	U	**0.12**	**J**	0.055	U	0.056	U	**0.55**	=	0.065	U	0.065	U	**120**	=	**0.23**	**J**	**0.17**	**J**	**0.74**	=	0.064	U	**7.7**	=
Fluorene	0.056	U	0.066	U	**0.11**	**J**	0.068	U	0.066	U	0.06	U	**86**	=	0.068	U	0.061	U	0.057	U	0.057	U	0.06	U	0.067	U	0.066	U	**10**	=	**0.14**	**J**	**0.069**	**J**	**0.083**	**J**	0.065	U	**0.85**	=
Indeno(1,2,3-cd)pyrene	**1.4**	=	0.049	U	**0.46**	**J**	**0.21**	**J**	0.05	U	0.045	U	**8**	=	0.051	U	0.046	U	0.042	U	0.043	U	**0.12**	**J**	0.05	U	0.05	U	**40**	=	0.048	U	0.048	U	**0.44**	=	0.049	U	**1.6**	=
Naphthalene	**0.17**	**J**	0.049	U	**0.41**	**J**	0.051	U	0.05	U	0.045	U	1700	=	**0.094**	**J**	0.046	U	0.042	U	0.043	U	0.045	U	0.05	U	0.05	U	2.8	=	**0.19**	**J**	**0.42**	**J**	**0.31**	**J**	0.049	U	2.4	=
Phenanthrene[2]	**2.4**	=	0.062	U	**0.57**	**J**	0.064	U	0.062	U	0.057	U	**98**	=	0.063	U	0.057	U	0.053	U	0.053	U	**0.19**	**J**	0.063	U	0.062	U	**55**	=	**0.4**	**J**	**0.22**	**J**	**0.43**	=	0.061	U	**3.2**	=
Phenol	**0.11**	**J**	0.049	U	**0.14**	**J**	0.051	U	0.05	U	0.045	U	**3.8**	=	**0.12**	**J**	0.046	U	0.042	U	0.043	U	0.045	U	**0.1**	**J**	**0.096**	**J**	**1**	=	0.048	U	0.048	U	**0.66**	=	**0.08**	**J**	**0.42**	**J**
Pyrene	**4.9**	=	0.063	U	**0.72**	**J**	**0.12**	**J**	0.064	U	0.058	U	**49**	=	0.065	U	**0.15**	**J**	0.054	U	0.054	U	**0.39**	**J**	0.064	U	0.063	U	**160**	=	**0.16**	**J**	**0.13**	**J**	**0.62**	=	0.063	U	**6.4**	=
Antimony, Total																																								
Arsenic, Total																																								
Barium, Total																																								
Beryllium, Total																																								
Cadmium, Total																																								
Chromium, Total																																								
Copper, Total																																								
Lead, Total																																								
Nickel, Total																																								
Selenium, Total																																								
Thallium, Total																																								
Zinc, Total																																								
Cyanide, Total																																								

results are in mg/kg or ppm
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)
Yellow Highlighted and bolded font exceeds Groundwater Protection Standard Soil Screening Levels (GWPS SSL)

Table A-2
SMA 4, Subsurface Soil 2 - 15 ft, - ERP Coke

Chemical Name	CM-SB0052 (8-10 ft) 16-Jan-08	CM-SB0053 (2-4 ft) 17-Jan-08	CM-SB0053 (7-9) 17-Jan-08	CM-SB0054 (2-4 ft) 17-Jan-08	CM-SB0054 (6-8 ft) 17-Jan-08	CM-SB0055 (2-4 ft) 15-Jan-08	CM-SB0056 (2-4 ft) 16-Jan-08	CM-SB0056 (7-9 ft) 16-Jan-08	CM-SB0057 (10-12 ft) 15-Jan-08	CM-SB0057 (2-4 ft) 15-Jan-08	CM-SB0057 (6-8 ft) 15-Jan-08	CM-SB0058 (2-4 ft) 15-Jan-08	CM-SB0058 (6-8 ft) 15-Jan-08	CM-SB0059 (2-4 ft) 17-Jan-08	CM-SB0059 (8-10 ft) 17-Jan-08	CM-SB0060 (3-5 ft) 15-Jan-08	CM-SB0060 (7-9 ft) 15-Jan-08	CM-SB0061 (2-4 ft) 15-Jan-08	CM-SB0061 (7-9 ft) 15-Jan-08	CM-SB0062 (12-14 ft) 15-Jan-08
1,1,2-Trichloroethane	0.0011 U	0.077 UJ	0.0012 UJ	0.0016 U	0.0016 U	0.0015 UJ	0.072 U	0.07 U	0.0013 U	0.0013 U	0.0011 U	0.048 U	0.0012 U	0.0012 UJ	**0.81 =**	0.15 U	0.0013 U	0.072 U	0.068 U	0.001 U
1,2,4-Trichlorobenzene	0.054 U	0.022 U	0.021 U	0.022 U	0.023 U	0.051 U	**0.038 J**	0.059 U	0.058 U	0.052 U	0.052 U	0.05 U	0.053 U	0.051 U	0.054 U	0.05 U	0.057 U	0.056 U	0.056 U	0.05 U
1,2-Dichloroethane	0.0018 U	0.13 UJ	0.0021 UJ	0.0026 U	0.0027 U	0.0025 UJ	0.12 U	0.12 U	0.0022 U	0.0022 U	0.0018 U	0.08 U	0.002 U	0.002 UJ	0.1 U	0.25 U	0.0022 U	0.12 U	0.11 U	0.0017 U
1,2-Dichloropropane	0.0011 U	0.077 UJ	0.0012 UJ	0.0016 U	0.0016 U	0.0015 UJ	0.072 U	0.07 U	0.0013 U	0.0013 U	0.0011 U	0.048 U	0.0012 U	0.0012 UJ	0.063 U	0.15 U	0.0013 U	0.072 U	0.068 U	0.001 U
1,4-Dichlorobenzene	0.045 U	0.019 U	0.018 U	0.018 U	0.019 U	0.043 U	0.0085 U	0.049 U	0.048 U	0.044 U	0.044 U	0.042 U	0.044 U	0.043 U	0.045 U	0.042 U	0.047 U	0.047 U	0.047 U	0.042 U
2-Butanone (MEK)	0.0097 U	0.71 UJ	0.011 UJ	0.014 U	0.015 U	0.013 UJ	0.66 U	0.64 U	0.012 U	0.012 U	0.0098 U	0.44 U	0.011 U	0.011 UJ	0.57 U	1.4 U	0.012 U	0.66 U	0.63 U	0.0093 U
Acetone	0.0045 UB	0.33 UJ	0.0053 UJ	**0.021 J**	0.007 U	**0.12 J**	0.3 U	**0.47 J**	0.0055 U	**0.037 J**	**0.0099 J**	0.21 U	**0.0072 J**	**0.026 J**	**0.3 J**	0.64 U	**0.014 J**	0.3 U	0.29 U	**0.022 J**
Benzene	**0.011 =**	**0.53 J**	**0.0026 J**	**0.019 =**	**0.0045 J**	**0.008 J**	**0.066 J**	**0.14 J**	0.0012 U	**0.0022 J**	**0.001 J**	**0.089 J**	0.0011 U	**0.0024 J**	3.8 =	32 =	1.8 =	0.62 =	0.64 =	0.00093 U
Carbon disulfide	0.00069 U	0.05 UJ	0.0008 UJ	**0.007 =**	0.0011 U	0.00096 UJ	0.047 U	0.045 U	0.00084 U	0.00084 U	0.00069 U	0.031 U	0.00076 U	**0.0039 J**	0.041 U	0.098 U	**0.0016 J**	0.047 U	0.044 U	0.00066 U
Carbon tetrachloride	0.0012 U	0.09 UJ	0.0014 UJ	0.0018 U	0.0019 U	0.0017 UJ	0.084 U	0.081 U	0.0015 U	0.0015 U	0.0012 U	0.056 U	0.0014 U	0.0014 UJ	0.073 U	0.18 U	0.0016 U	0.084 U	0.08 U	0.0012 U
Chlorobenzene	0.00097 U	**0.79 J**	0.0011 UJ	0.0014 U	**0.0023 J**	**0.036 J**	0.066 U	0.064 U	0.0012 U	0.0012 U	0.00098 U	**1.4 =**	0.0011 U	0.0011 UJ	0.057 U	0.14 U	**0.0091 =**	0.066 U	**0.0061 J**	0.00093 U
Chloroethane	0.0013 U	0.096 UJ	0.0015 UJ	0.002 U	0.0021 U	0.0018 UJ	0.089 U	0.087 U	0.0016 U	0.0016 U	0.0013 U	0.06 U	0.0015 U	0.0015 UJ	**0.12 J**	0.19 U	0.0017 U	0.09 U	0.085 U	0.0013 U
Chloroform	0.00072 U	0.053 UJ	0.00085 UJ	0.0011 U	0.0011 U	0.001 UJ	0.049 U	0.048 U	0.00088 U	0.00088 U	0.00073 U	0.033 U	0.0008 U	0.00082 UJ	0.043 U	0.1 U	0.00091 U	0.049 U	0.047 U	0.00069 U
cis-1,2-Dichloroethene	**0.023 =**	**0.21 J**	0.00099 UJ	0.0013 U	**0.15 =**	0.0012 UJ	0.057 U	0.056 U	0.001 U	0.001 U	0.00085 U	0.039 U	0.00094 U	0.00095 UJ	0.05 U	0.12 U	**0.014 =**	0.057 U	0.055 U	0.00081 U
cis-1,3-Dichloropropene	0.00088 U	0.064 UJ	0.001 UJ	0.0013 U	0.0014 U	0.0012 UJ	0.06 U	0.058 U	0.0011 U	0.0011 U	0.00089 U	0.04 U	0.00098 U	0.00099 UJ	**0.12 J**	0.13 U	0.0011 U	0.06 U	0.057 U	0.00084 U
Ethylbenzene	0.0016 U	0.12 UJ	0.0019 UJ	0.0024 U	0.0025 U	0.0022 UJ	0.11 U	0.1 U	0.0019 U	0.0019 U	0.0016 U	0.072 U	0.0018 U	0.0018 UJ	0.094 U	**0.69 =**	**0.038 =**	**0.15 J**	0.1 U	0.0015 U
m- and p-Xylenes	0.00065 U	**0.087 J**	0.00076 UJ	0.00097 UB	0.001 UB	**0.0027 J**	0.044 U	0.043 U	0.0008 U	0.0008 U	**0.00073 J**	**0.45 =**	0.00072 U	0.00074 UJ	**0.04 J**	**4.9 =**	**0.094 =**	**1.3 =**	**0.00075 J**	**0.0007 J**
Methylene chloride	0.0014 U	**0.2 J**	0.0016 UJ	0.0021 U	0.0022 U	0.002 UJ	**0.28 J**	**0.33 =**	0.0017 U	0.0017 U	0.0014 U	0.064 U	0.0016 U	0.0016 UJ	**0.85 =**	0.2 U	0.0018 U	0.096 U	0.091 U	0.0014 U
o-Xylene	0.00053 U	0.038 UJ	0.00062 UJ	0.00079 U	0.00082 U	**0.001 J**	**0.039 J**	0.035 U	0.00065 U	0.00065 U	0.00053 U	**0.11 J**	0.00059 U	0.0006 UJ	0.031 U	**3.1 =**	**0.1 =**	**0.31 =**	**0.0007 J**	0.00051 U
Styrene	0.00054 U	0.039 UJ	0.00063 UJ	0.0008 U	0.00084 U	0.00075 UJ	0.036 U	0.035 U	0.00066 U	0.00066 U	0.00054 U	0.025 U	0.0006 U	0.00061 UJ	0.032 U	0.077 U	0.00068 U	0.036 U	0.035 U	0.00052 U
Tetrachloroethene	**0.0022 J**	0.058 UJ	0.00093 UJ	0.0012 U	**0.15 =**	0.0011 UJ	**0.38 =**	0.052 U	0.00097 U	0.00097 U	0.0008 U	0.036 U	0.00088 U	0.00089 UJ	0.047 U	0.11 U	0.001 U	0.054 U	0.051 U	0.00076 U
Toluene	0.00088 U	**0.32 J**	0.001 U	0.0013 UB	0.0014 UB	**0.016 J**	**0.19 J**	0.058 U	**0.0013 J**	**0.0028 J**	**0.0018 J**	**0.25 =**	**0.002 J**	0.00099 UJ	0.052 U	**17 =**	**0.031 =**	120 =	**0.0025 J**	**0.0029 J**
trans-1,2-Dichloroethene	0.00087 U	0.064 UJ	0.001 UJ	0.0013 U	**0.0014 J**	0.0012 UJ	0.059 U	0.057 U	0.0011 U	0.0011 U	0.00088 U	0.04 U	0.00097 U	0.00098 UJ	0.052 U	0.12 U	0.0011 U	0.059 U	0.056 U	0.00084 U
trans-1,3-Dichloropropene	0.00085 U	0.062 UJ	0.001 UJ	0.0013 U	0.0013 U	0.0012 UJ	0.058 U	0.056 U	0.001 U	0.001 U	0.00086 U	0.039 U	0.00095 U	0.00096 UJ	0.051 U	0.12 U	0.0011 U	0.058 U	0.055 U	0.00082 U
Trichloroethene	**0.0085 =**	0.058 UJ	0.00093 UJ	0.0012 UJ	**0.044 J**	0.0011 UJ	0.054 U	0.052 U	0.00097 U	0.00097 U	0.0008 U	0.036 U	0.00088 U	0.00089 UJ	0.047 UJ	0.11 U	0.001 U	0.054 U	0.051 U	0.00076 U
Vinyl chloride	**0.095 =**	0.1 UJ	0.0016 UJ	0.12 =	0.04 =	0.002 UJ	0.095 U	0.093 U	0.0017 U	0.0017 U	0.0014 U	0.064 U	0.0016 U	0.0016 UJ	0.084 U	0.2 U	0.022 =	0.096 U	0.091 U	0.0014 U
Xylenes	0.0011 U	**0.12 J**	0.0013 UJ	**0.0024 J**	0.0018 U	**0.0037 J**	0.078 U	0.075 U	0.0014 U	0.0014 U	0.0012 U	**0.56 =**	0.0013 U	0.0013 UJ	0.068 U	**7.9 =**	**0.2 =**	**1.6 =**	**0.0015 J**	0.0011 U
1-Methylnaphthalene	0.046 U	**0.025 J**	0.018 U	**0.019 J**	0.02 U	0.044 U	**0.026 J**	0.051 U	0.05 U	0.045 U	0.045 U	0.043 U	0.046 U	0.044 U	0.046 U	0.54 =	0.049 U	0.63 =	0.048 U	0.043 U
2-Chlorophenol	0.054 U	0.022 U	0.021 U	0.022 U	0.023 U	0.051 U	0.01 U	0.059 U	0.058 U	0.052 U	0.052 U	0.05 U	0.053 U	0.051 U	0.054 U	0.05 U	0.057 U	0.056 U	0.056 U	0.05 U
2-Methylnaphthalene	0.046 U	**0.039 J**	0.018 U	**0.027 J**	0.02 U	0.044 U	**0.044 J**	0.051 U	0.05 U	0.045 U	0.045 U	0.043 U	0.046 U	0.044 U	0.046 U	**0.8 =**	0.049 U	**0.77 =**	0.048 U	0.043 U
2-Methylphenol (o-cresol)	0.053 U	0.022 U	0.021 U	0.021 U	0.023 U	0.05 U	0.01 U	0.058 U	0.057 U	0.051 U	0.051 U	0.049 U	0.052 U	0.05 U	0.052 U	0.049 U	0.055 U	0.055 U	0.055 U	0.049 U
3 & 4 Methylphenol	0.054 U	0.022 U	0.021 U	0.022 U	0.023 U	0.051 U	0.01 U	0.059 U	0.058 U	0.052 U	0.052 U	0.05 U	0.053 U	0.051 U	0.054 U	0.05 U	0.057 U	0.056 U	0.056 U	0.05 U
4-Methylphenol (p-cresol)																				
Acenaphthene	0.046 U	**0.044 J**	0.018 U	**0.048 J**	0.02 U	0.044 U	0.0088 U	0.051 U	0.05 U	0.045 U	0.045 U	**0.14 J**	0.046 U	0.044 U	0.046 U	**0.2 J**	0.049 U	**0.42 J**	0.048 U	0.043 U
Acenaphthylene[2]	0.05 U	**0.058 J**	0.02 U	**0.054 J**	0.021 U	0.048 U	0.0095 U	0.055 U	0.054 U	0.048 U	0.049 U	0.047 U	0.049 U	**0.21 J**	0.05 U	**0.19 J**	0.053 U	**0.8 =**	0.052 U	0.047 U
Anthracene	0.063 U	**0.17 J**	0.025 U	**0.099 J**	0.027 U	0.06 U	0.012 U	0.069 U	0.068 U	0.061 U	0.061 U	**0.21 J**	0.062 U	**0.32 J**	0.062 U	**0.59 =**	0.066 U	**2.9 =**	0.066 U	0.059 U
Benzo(a)anthracene	0.049 U	**0.86 =**	0.019 U	**0.52 =**	0.021 U	**0.15 J**	**0.093 =**	0.054 U	0.052 U	0.047 U	0.047 U	0.046 U	0.048 U	**1 =**	0.048 U	1.2 =	0.051 U	9 =	0.051 U	0.046 U
Benzo(a)pyrene	0.046 U	**1 =**	0.018 U	**0.69 =**	0.02 U	**0.13 J**	**0.13 =**	0.051 U	0.05 U	0.045 U	0.045 U	**2.5 =**	0.046 U	**1.4 =**	0.046 U	**1.4 =**	0.049 U	**8.3 =**	0.048 U	0.043 U
Benzo(b)fluoranthene	0.065 U	**1.5 =**	0.026 U	**1.1 =**	0.028 U	**0.23 J**	**0.22 =**	0.072 U	0.07 U	0.063 U	0.064 U	3.4 =	0.065 U	**1.7 =**	0.065 U	2.3 =	0.069 U	14 =	0.068 U	0.061 U
Benzo(g,h,i)perylene[2]	0.05 U	**0.61 =**	0.02 U	**0.45 =**	0.021 U	**0.11 J**	**0.084 =**	0.055 U	0.054 U	0.048 U	0.049 U	**1.4 =**	0.049 U	**0.99 =**	0.05 U	**0.23 J**	0.053 U	**5.4 =**	0.052 U	0.047 U
Benzo(k)fluoranthene	0.046 U	**0.47 =**	0.018 U	**0.35 =**	0.02 U	**0.12 J**	**0.065 J**	0.051 U	0.05 U	0.045 U	0.045 U	**1.1 =**	0.046 U	**0.88 =**	0.046 U	**0.88 =**	0.049 U	**4.1 =**	0.048 U	0.043 U
Bis(2-ethylhexyl)phthalate	0.047 U	**0.048 J**	0.019 U	0.019 U	0.02 U	0.045 U	0.009 U	0.052 U	0.051 U	0.046 U	0.046 U	0.044 U	0.047 U	0.045 U	0.047 U	0.044 U	0.05 U	0.05 U	0.05 U	0.044 U
Carbazole	0.047 U	**0.053 J**	0.019 U	**0.045 J**	0.02 U	0.045 U	0.009 U	0.052 U	0.051 U	0.046 U	0.046 U	0.044 U	0.047 U	**0.095 J**	0.047 U	0.75 =	0.05 U	1.4 =	0.05 U	0.044 U
Chrysene	0.045 U	**0.83 =**	0.018 U	**0.5 =**	0.019 U	**0.14 J**	**0.14 =**	0.049 U	0.048 U	0.044 U	0.044 U	0.042 U	0.044 U	**1.2 =**	0.045 U	**1.4 =**	0.047 U	**8.9 =**	0.047 U	0.042 U
Dibenzo(a,h)anthracene	0.045 U	**0.2 =**	0.018 U	**0.15 J**	0.019 U	0.043 U	**0.033 J**	0.049 U	0.048 U	0.044 U	0.044 U	**0.46 =**	0.044 U	**0.36 J**	0.045 U	**0.27 J**	0.047 U	**1.8 =**	0.047 U	0.042 U
Dibenzofuran	0.064 U	**0.051 J**	0.025 U	**0.045 J**	0.027 U	0.061 U	0.012 U	0.071 U	0.069 U	0.062 U	0.062 U	0.06 U	0.063 U	0.061 U	0.064 U	0.47 =	0.068 U	1.1 =	0.067 U	0.06 U
Diethylphthalate	0.05 U	0.021 U	0.02 U	0.02 U	0.021 U	0.048 U	0.0095 U	0.055 U	0.054 U	0.048 U	0.049 U	0.047 U	0.049 U	0.048 U	0.05 U	0.047 U	0.053 U	0.052 U	0.052 U	0.047 U
Fluoranthene	0.06 U	**1.2 =**	0.024 U	**0.73 =**	0.026 U	**0.18 J**	**0.14 =**	0.066 U	0.065 U	0.058 U	0.059 U	**2.4 =**	0.06 U	**1.5 =**	0.06 U	**2.6 =**	0.064 U	**23 =**	0.063 U	0.056 U
Fluorene	0.062 U	**0.12 J**	0.024 U	**0.053 J**	0.026 U	0.059 U	0.012 U	0.068 U	0.066 U	0.06 U	0.06 U	**0.15 J**	0.061 U	**0.13 J**	0.061 U	**1 =**	0.065 U	**3 =**	0.064 U	0.058 U
Indeno(1,2,3-cd)pyrene	0.046 U	**0.37 J**	0.018 UJ	**0.27 J**	0.02 U	**0.16 J**	**0.064 J**	0.051 U	0.05 U	0.045 U	0.045 U	**0.95 =**	0.046 U	**0.71 J**	0.046 UJ	**0.68 =**	0.049 U	**4.2 =**	0.048 U	0.043 U
Naphthalene	0.046 U	**0.11 J**	0.018 U	**0.11 J**	0.02 U	0.044 U	**0.046 J**	0.051 U	0.05 U	0.045 U	0.045 U	**0.33 J**	0.046 U	0.044 U	0.49 =	5.7 =	0.049 U	**3.7 =**	**0.33 J**	0.043 U
Phenanthrene[2]	0.058 U	**0.52 =**	0.023 U	**0.17 J**	0.025 U	0.055 U	**0.067 J**	0.064 U	0.062 U	0.056 U	0.056 U	**0.4 =**	0.057 U	**0.82 =**	0.057 U	**2.7 =**	0.061 U	**17 =**	0.06 U	0.054 U
Phenol	0.046 U	**0.081 J**	**0.046 J**	**0.078 J**	**0.051 J**	0.044 U	0.0088 U	0.051 U	0.05 U	0.045 U	0.045 U	0.043 U	0.046 U	0.044 U	**0.34 J**	**7.9 =**	0.049 U	**1.2 =**	0.048 U	0.043 U
Pyrene	0.059 U	**1.8 J**	0.023 UJ	**0.86 J**	0.025 U	**0.18 J**	**0.13 =**	0.065 U	0.063 U	0.057 U	0.057 U	**2.2 =**	0.058 U	**2 J**	0.059 UJ	**2.6 =**	0.062 U	**17 =**	0.062 U	0.055 U
Antimony, Total																				
Arsenic, Total																				
Barium, Total																				
Beryllium, Total																				
Cadmium, Total																				
Chromium, Total																				
Copper, Total																				
Lead, Total																				
Nickel, Total																				
Selenium, Total																				
Thallium, Total																				
Zinc, Total																				
Cyanide, Total																				

results are in mg/kg or ppm
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)
Yellow Highlighted and bolded font exceeds Groundwater Protection Standard Soil Screening Levels (GWPS SSL)

Table A-2
SMA 4, Subsurface Soil 2 - 15 ft, - ERP Coke

Chemical Name	CM-SB0062 (2-4 ft) 15-Jan-08	CM-SB0062 (7-9 ft) 15-Jan-08	CM-SB0063 (2-4 ft) 17-Jan-08	CM-SB0063 (5-7 ft) 17-Jan-08	26-SB0001 (13-15) 09-Jun-99	26-SB0001 (5-7) 09-Jun-99	26-SB0001 (9-11) 09-Jun-99	26-SB0002 (2-4) 09-Jun-99	26-SB0002 (4-6) 09-Jun-99	26-SB0002 (6-8) 09-Jun-99	27-SB0001 (10-12) 10-Jun-99	27-SB0001 (2-4) 10-Jun-99	27-SB0001 (6-8) 10-Jun-99	27-SB0002 (3-5) 11-Jun-99	27-SB0002 (5-7) 11-Jun-99	27-SB0002 (9-11) 11-Jun-99	29-SB0001 (12-13) 09-Jun-99	29-SB0001 (4-6) 09-Jun-99	29-SB0001 (8-10) 09-Jun-99	29-SB0002 (4-4.5) 09-Jun-99	31-SB0001 (0.5-2) 10-Jun-99	31-SB0001 (2-4) 10-Jun-99
1,1,2-Trichloroethane	0.087 U	0.0011 U	0.079 U	0.069 U	0.13 U	0.12 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.14 U	0.14 U	0.14 U	0.13 U	0.14 U	0.13 U	0.12 U
1,2,4-Trichlorobenzene	0.024 U	0.053 U	0.052 U	0.057 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	**0.93** =	0.42 U	0.41 U
1,2-Dichloroethane	0.14 U	0.0018 U	0.13 U	0.12 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	0.35 U	0.32 U	0.31 U
1,2-Dichloropropane	0.087 U	0.0011 U	0.079 U	0.069 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	0.35 U	0.32 U	0.31 U
1,4-Dichlorobenzene	0.02 U	0.044 U	0.044 U	0.048 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
2-Butanone (MEK)	0.79 U	0.0099 U	0.72 U	0.64 U	3.1 U	3.1 U	3.1 U	3.3 U	3.5 U	2.9 U	3.3 U	3.2 U	3.2 U	3.3 U	3.2 U	3.4 U	3.5 U	3.4 U	3.3 U	3.5 U	3.2 U	3.1 U
Acetone	0.37 U	**0.023** J	0.33 U	0.3 U	3.1 U	3.1 U	3.1 U	3.3 U	3.5 U	2.9 U	3.3 U	3.2 U	3.2 U	3.3 U	3.2 U	3.4 U	3.5 U	**3.4** =	3.3 U	3.5 U	3.2 U	3.1 U
Benzene	**0.12** J	**0.003** J	**0.31** J	0.064 U	5.5 =	15 =	10 =	2.9 =	8.4 =	2.4 =	1.6 =	3.4 =	0.89 =	8.6 =	14 =	1.2 =	6.5 =	5 =	3.9 =	59 =	2.3 =	0.76 =
Carbon disulfide	0.056 U	0.0007 U	0.051 U	0.045 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	0.35 U	0.32 U	0.31 U
Carbon tetrachloride	0.1 U	0.0013 U	0.092 U	0.081 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	0.35 U	0.32 U	0.31 U
Chlorobenzene	**0.087** J	0.00099 U	0.072 U	**0.3** =	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	**29** =	420 =	72 =	350 =	6100 =	330 =	**22** =	**19** =	**15** =	**21** =	**2.1** =	**1** =
Chloroethane	0.11 U	0.0013 U	0.098 U	0.087 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	0.35 U	0.32 U	0.31 U
Chloroform	0.059 U	0.00074 U	0.054 U	0.047 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	0.35 U	0.32 U	0.31 U
cis-1,2-Dichloroethene	0.069 U	0.00086 U	0.063 U	0.056 U		0.31 U	0.31 U															
cis-1,3-Dichloropropene	0.072 U	0.0009 U	0.065 U	0.058 U	0.31 U			0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	0.35 U	0.32 U	0.31 U
Ethylbenzene	0.13 U	0.0016 U	0.12 U	0.1 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	**0.93** =	**32** =	**11** =
m- and p-Xylenes	**0.085** J	0.00066 U	**0.21** J	0.043 U																		
Methylene chloride	0.12 U	0.0014 U	0.1 U	0.093 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	0.35 U	0.32 U	0.31 U
o-Xylene	0.043 U	0.00054 U	**0.084** J	0.035 U			0.31 U															
Styrene	0.044 U	0.00055 U	0.04 U	0.035 U	0.31 U	0.31 U		0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	0.35 U	0.32 U	0.31 U
Tetrachloroethene	0.065 U	0.00081 U	0.059 U	0.052 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	**1.2** =	0.32 U	0.31 U
Toluene	**1.4** =	0.0009 U	**0.65** =	0.058 U	0.13 U	0.12 U	0.13 U	0.13 U	0.14 U	0.12 U	**17** =	1000 =	42 =	130 =	160 =	**14** =	210 =	210 =	120 =	36 =	**10** =	**8.7** =
trans-1,2-Dichloroethene	0.071 U	0.00089 U	0.065 U	0.057 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	0.35 U	0.32 U	0.31 U
trans-1,3-Dichloropropene	0.07 U	0.00087 U	0.064 U	0.056 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	0.32 U	0.32 U	0.33 U	0.32 U	0.34 U	0.35 U	0.34 U	0.33 U	0.35 U	0.32 U	0.31 U
Trichloroethene	0.065 U	0.00081 U	0.059 UJ	0.052 UJ	0.13 U	0.12 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.14 U	0.14 U	0.14 U	0.13 U	0.14 U	0.13 U	0.12 U
Vinyl chloride	0.12 U	0.0014 U	0.1 U	0.093 U	0.063 U	0.062 U	0.063 U	0.066 U	0.069 U	0.059 U	0.066 U	0.063 U	0.065 U	0.066 U	0.064 U	0.068 U	0.07 U	0.068 U	0.067 U	0.087 =	0.063 U	0.062 U
Xylenes	**0.12** J	0.0012 U	**0.29** J	0.075 U	0.31 U	0.31 U	0.31 U	0.33 U	0.35 U	0.29 U	0.33 U	**4.9** =	0.32 U	**0.54** =	**1.3** =	0.34 U	**5.8** =	**8.1** =	**4.6** =	**12** =	**160** =	**31** =
1-Methylnaphthalene	0.021 U	0.045 U	**0.17** J	0.049 U																		
2-Chlorophenol	0.024 U	0.053 U	0.052 U	0.057 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
2-Methylnaphthalene	0.021 U	0.045 U	**0.32** J	0.049 U	0.41 U	0.41 U	**3.1** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
2-Methylphenol (o-cresol)	0.024 U	0.052 U	0.051 U	0.056 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U	0.43 U	**0.67** =	0.43 U	0.43 U	0.42 U	0.45 U	**0.49** =	0.45 U	**0.47** =	0.46 U	0.42 U	0.41 U
3 & 4 Methylphenol	0.024 U	0.053 U	0.052 U	0.057 U																		
4-Methylphenol (p-cresol)					0.41 U	0.41 U	**0.4** =	0.43 U	0.46 U	0.39 U	0.43 U	0.86 =	0.43 U	0.43 U	0.42 U	0.45 U	1.3 =	1.3 =	1.5 =	0.52 =	0.42 U	0.41 U
Acenaphthene	0.021 U	0.045 U	**0.17** J	0.049 U	0.41 U	0.41 U	**0.68** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Acenaphthylene[2]	0.023 U	0.049 U	**0.48** =	0.053 U	0.41 U	0.41 U	**1.9** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Anthracene	0.028 U	0.062 U	**0.92** =	0.067 U	0.41 U	0.41 U	**2.4** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Benzo(a)anthracene	0.022 U	0.048 U	4.4 =	0.052 U	0.41 U	0.41 U	5.4 =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Benzo(a)pyrene	0.021 U	0.045 U	**4.3** =	0.049 U	0.41 U	0.41 U	**3.6** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Benzo(b)fluoranthene	0.029 U	0.064 U	7 =	0.07 U	0.41 U	0.41 U	4.9 =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Benzo(g,h,i)perylene[2]	0.023 U	0.049 U	**2.3** =	0.053 U	0.41 U	0.41 U	**1.9** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Benzo(k)fluoranthene	0.021 U	0.045 U	**2.5** =	0.049 U	0.41 U	0.41 U	**2.1** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Bis(2-ethylhexyl)phthalate	0.021 U	0.047 U	0.046 U	0.051 U	**0.43** =	0.41 U	0.41 U	0.43 U	**0.69** =	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	**0.75** =	0.45 U	**0.6** =	0.46 U	0.42 U	0.41 U
Carbazole	0.021 U	0.047 U	**0.23** J	0.051 U																		
Chrysene	0.02 U	0.044 U	**4.7** =	0.048 U	0.41 U	0.41 U	**4** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Dibenzo(a,h)anthracene	0.02 U	0.044 U	**0.85** =	0.048 U	0.41 U	0.41 U	**0.51** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Dibenzofuran	0.029 U	0.063 U	**0.24** J	0.068 U	0.41 U	0.41 U	2.1 =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Diethylphthalate	0.023 U	0.049 U	0.049 U	0.053 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Fluoranthene	0.027 U	0.059 U	**9.1** =	0.064 U	**1** =	0.41 U	**14** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Fluorene	0.028 U	0.061 U	**0.32** J	0.066 U	0.41 U	0.41 U	**4** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Indeno(1,2,3-cd)pyrene	0.021 U	0.045 U	**1.6** J	0.049 UJ	0.41 U	0.41 U	**1.9** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Naphthalene	**0.059** J	0.045 U	0.72 =	0.049 U	1.5 =	0.41 U	38 =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Phenanthrene[2]	0.026 U	0.057 U	**3.1** =	0.061 U	**1.1** =	0.41 U	**14** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Phenol	**0.038** J	0.045 U	**0.52** =	0.049 U	0.41 U	0.41 U	0.41 U	0.43 U	0.46 U	0.39 U	**0.67** =	**85** =	**91** =	**67** =	**180** =	**180** =	**35** =	**11** =	**7.1** =	**2** =	**20** =	**1.2** =
Pyrene	0.027 U	0.058 U	**9.6** J	0.063 UJ	**0.56** =	0.41 U	**8.8** =	0.43 U	0.46 U	0.39 U	0.43 U	0.42 U	0.43 U	0.43 U	0.42 U	0.45 U	0.46 U	0.45 U	0.44 U	0.46 U	0.42 U	0.41 U
Antimony, Total					**0.65** =	**0.59** =	0.6 U	**0.6** =	0.69 U	0.54 U	0.61 U	0.59 U	0.63 U	0.65 U	0.64 U	0.66 U	0.68 U	0.64 U	0.64 U	0.69 U	**0.61** =	**1.2** =
Arsenic, Total					**3.3** =	**2.3** =	**3.5** =	**4** =	**5.1** =	**5.3** =	**4.8** =	**5.1** =	15 =	18 =	11 =	10 =	**2.9** =	**5.6** =	6.2 =	**4** =	8.4 =	**5.3** =
Barium, Total					**12** =	**8.7** =	**12** =	**27** =	**23** =	**30** =	**13** =	**27** =	**12** =	**21** =	**20** =	**21** =	**19** =	**19** =	**4.2** =	**26** =	**39** =	**49** =
Beryllium, Total					0.06 U	0.06 U	0.06 U	0.06 U	0.07 U	0.05 U	**0.2** =	0.06 U	**0.55** =	0.07 U	0.06 U	0.07 U	**0.2** =	0.06 U	**0.95** =	0.07 U	0.06 U	0.06 U
Cadmium, Total					**1.6** =	**1.4** =	**1.2** =	**1.2** =	**1** =	**0.74** =	**0.34** =	**0.83** =	**0.25** =	**2** =	**1.8** =	**1.6** =	**0.4** =	**1.4** =	0.06 U	**0.65** =	**1.5** =	**3.4** =
Chromium, Total					**19** =	**20** =	**19** =	**8.6** =	**10** =	**18** =	**2.8** =	**36** =	**2** =	**22** =	**17** =	**13** =	**2.2** =	**9.8** =	**0.64** =	**6.4** =	**22** =	**23** =
Copper, Total					0.23 U	0.23 U	0.24 U	**2.7** =	**4.7** =	0.22 U	**1.8** =	0.24 U	**0.94** =	**1.3** =	0.25 U	0.26 U	**4.2** =	**2.3** =	**0.86** =	**1.1** =	**13** =	0.24 U
Lead, Total					**6.6** =	**6.6** =	**11** =	**6.9** =	**7.4** =	**15** =	**2.5** =	**24** =	**30** =	**46** =	**6.1** =	**5.2** =	**2.4** =	**5.9** =	**0.85** =	**3.3** =	**16** =	**18** =
Nickel, Total					**2.9** =	**1.7** =	**2.5** =	**4.4** =	**4.7** =	**2.7** =	**3.6** =	**12** =	**3.1** =	**2.7** =	**3.1** =	**2.6** =	**5.6** =	**5.7** =	**2.4** =	**4.1** =	**5.1** =	**2.8** =
Selenium, Total					0.12 U	0.11 U	0.12 U	0.11 U	0.13 U	0.11 U	0.12 U	0.12 U	0.13 U	**1.2** =	**1** =	**0.89** =	0.13 U	0.12 U	0.11 U	0.13 U	0.13 U	0.12 U
Thallium, Total					**0.03** =	**0.06** =	**0.06** =	**0.07** =	**0.08** =	**0.08** =	**0.07** =	**0.11** =	**0.08** =	**0.09** =	**0.07** =	**0.07** =	**0.05** =	**0.1** =	**0.08** =	**0.09** =	**0.09** =	**0.09** =
Zinc, Total					**5.4** =	**3** =	**4.1** =	**7.4** =	**10** =	**4.8** =	**4.6** =	**11** =	**2.2** =	**8.2** =	**8.1** =	**6.2** =	**7.6** =	**11** =	**1.7** =	**6.8** =	**23** =	**7.8** =
Cyanide, Total					**1.7** =	**1.7** =	**1.7** =	0.26 U	0.28 U	**2.4** =	0.26 U	0.25 U	0.26 U	**0.28** =	0.26 U	**0.32** =	0.28 U	0.27 U	**0.31** =	0.28 U	0.25 U	0.25 U

results are in mg/kg or ppm
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)
Yellow Highlighted and bolded font exceeds Groundwater Protection Standard Soil Screening Levels (GWPS SSL)

Table A-2
SMA 4, Subsurface Soil 2 - 15 ft, - ERP Coke

Chemical Name	31-SB0001 (6-8) 10-Jun-99	31-SB0002 (2-4) 10-Jun-99	31-SB0002 (4-6) 10-Jun-99	31-SB0002 (8-10) 10-Jun-99	MW-52 (0-2) 11-Jul-00	MW-52 (4-6) 11-Jul-00	MW-52 (8-10) 11-Jul-00	MW-53 (2-4) 12-Jul-00	MW-53 (4-6) 12-Jul-00	MW-53 (8-10) 12-Jul-00	MW-54 (2-4) 12-Jul-00	MW-54 (8-10) 12-Jul-00	MW-55 (2.5-4) 11-Jul-00	MW-55 (4-6) 11-Jul-00	MW-55 (6-8) 11-Jul-00	PCS	GWP SSL
1,1,2-Trichloroethane	0.12 U	0.12 U	0.14 U	0.13 U	0.11 U	0.14 U	0.13 U	0.12 U	0.13 U	0.14 U	0.12 U	0.12 U	0.13 U	0.14 U	0.13 U		0.054
1,2,4-Trichlorobenzene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		5.3
1,2-Dichloroethane	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		0.04
1,2-Dichloropropane	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		0.06
1,4-Dichlorobenzene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		3.58
2-Butanone (MEK)	3 U	3 U	3.4 U	3.3 U	2.8 U	3.5 U	3.3 U	3.1 U	3.3 U	3.6 U	3 U	2.9 U	3.2 U	3.4 U	3.3 U		31
Acetone	3 U	3 U	3.4 U	3.3 U	2.8 U	3.5 U	3.3 U	3.1 U	3.3 U	3.6 U	3 U	2.9 U	3.2 U	3.4 U	3.3 U		92
Benzene	**0.81 =**	**3.3 =**	**0.53 =**	0.33 U	0.28 U	0.35 U	0.33 U	**1.2 =**	**2.6 =**	**3.9 =**	**0.95 =**	0.29 U	**1.5 =**	**0.64 =**	0.33 U	409	0.11
Carbon disulfide	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		5.2
Carbon tetrachloride	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		0.05
Chlorobenzene	0.3 U	**3 =**	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	**7.9 =**	**5.2 =**	**1.2 =**	1171	3.1
Chloroethane	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		0.59
Chloroform	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		0.0015
cis-1,2-Dichloroethene																	0.61
cis-1,3-Dichloropropene	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		0.01
Ethylbenzene	**0.77 =**	**0.39 =**	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		40
m- and p-Xylenes																	490
Methylene chloride	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		0.033
o-Xylene																	490
Styrene	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		5.6
Tetrachloroethene	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		0.08
Toluene	**2.3 =**	**3.4 =**	**0.34 =**	0.13 U	0.11 U	0.14 U	0.13 U	0.12 U	**6.9 =**	**10 =**	1.3 UJ	0.12 U	**0.49 =**	**1.5 =**	**0.9 =**	21785	31
trans-1,2-Dichloroethene	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		0.91
trans-1,3-Dichloropropene	0.3 U	0.3 U	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	0.31 U	0.33 U	0.36 U	0.3 U	0.29 U	0.32 U	0.34 U	0.33 U		0.01
Trichloroethene	0.12 U	0.12 U	0.14 U	0.13 U	0.11 U	0.14 U	0.13 U	0.12 U	0.13 U	0.14 U	0.12 U	0.12 U	0.13 U	0.14 U	0.13 U		0.058
Vinyl chloride	0.061 U	0.06 U	0.068 U	0.067 U	0.057 U	0.07 U	0.066 U	0.062 U	0.066 U	0.071 U	0.06 U	0.059 U	0.064 U	0.068 U	0.066 U		0.017
Xylenes	**5.1 =**	**2 =**	0.34 U	0.33 U	0.28 U	0.35 U	0.33 U	**2.9 =**	**1.4 =**	**3 =**	**2.5 J**	0.29 U	0.32 U	0.34 U	0.33 U		490
1-Methylnaphthalene																	0.006
2-Chlorophenol	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		0.0074
2-Methylnaphthalene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	**0.41 =**	0.39 U	0.42 U	0.45 U	0.43 U		45
2-Methylphenol (o-cresol)	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		87
3 & 4 Methylphenol																	0.17
4-Methylphenol (p-cresol)	**0.7 =**	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		0.15
Acenaphthene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		1400
Acenaphthylene[2]	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		23000
Anthracene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		5.8
Benzo(a)anthracene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	**0.55 =**	**0.54 =**	0.42 U	0.45 U	0.43 U		1
Benzo(a)pyrene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	**0.42 =**	**0.42 =**	0.42 U	0.45 U	0.43 U	28	16
Benzo(b)fluoranthene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		2
Benzo(g,h,i)perylene[2]	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		nd
Benzo(k)fluoranthene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		23
Bis(2-ethylhexyl)phthalate	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		100
Carbazole																	0.1
Chrysene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	**0.47 =**	**0.5 =**	0.42 U	0.45 U	0.43 U		69
Dibenzo(a,h)anthracene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		1
Dibenzofuran	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		0.015
Diethylphthalate	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		480
Fluoranthene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	**1.8 =**	**1.6 =**	0.42 U	0.45 U	0.43 U		11000
Fluorene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	**0.7 =**	**0.62 =**	0.42 U	0.45 U	0.43 U		1700
Indeno(1,2,3-cd)pyrene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		8
Naphthalene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	**1.8 =**	**1.1 =**	0.42 U	0.45 U	0.43 U		0.026
Phenanthrene[2]	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	**1.7 =**	**2 =**	0.42 U	0.45 U	0.43 U		nd
Phenol	**1.2 =**	**0.76 =**	**0.79 =**	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	**0.62 =**	0.39 U	0.39 U	0.42 U	0.45 U	0.43 U		339.65
Pyrene	0.4 U	0.4 U	0.45 U	0.44 U	0.38 U	0.46 U	0.43 U	0.41 U	0.43 U	0.47 U	**1.1 =**	**1.1 =**	0.42 U	0.45 U	0.43 U		7700
Antimony, Total	**0.76 =**	**0.98 =**	0.67 U	0.66 U													5.4
Arsenic, Total	**5.2 =**	**4.3 =**	**4.3 =**	**1.5 =**	**7.9 =**	**15 =**	**16 =**	**18 =**	**9.2 =**	**16 =**	**9.9 =**	**8.1 =**	**12 =**	**12 =**	**9.2 =**		6
Barium, Total	**48 =**	**98 =**	**42 =**	**31 =**	**49 =**	**34 =**	**37 =**	**42 =**	**26 =**	**64 =**	**140 =**	**1600 =**	**45 =**	**26 =**	**68 =**		1800
Beryllium, Total	0.06 U	0.06 U	**0.48 =**	**0.21 =**	**1.1 =**	0.7 U	**1.3 =**	**0.7 =**	**1.5 =**	**1.5 =**	**1.7 =**	**3.5 =**	0.6 U	0.7 U	**3.3 =**		700
Cadmium, Total	**1.8 =**	**3.6 =**	**1.1 =**	**0.26 =**	**1 J**	**2 J**	**2 J**	**4.8 J**	**11 J**	**2.4 J**	**9.3 J**	**5.4 J**	**2.1 J**	**2.7 J**	**1.6 J**		40
Chromium, Total	**13 =**	**19 =**	**9.5 =**	**3.5 =**	**10 J**	**34 J**	**23 J**	**60 J**	**120 J**	**35 J**	**53 J**	**82 J**	**38 J**	**4.3 J**	**28 J**		36
Copper, Total	0.24 U	0.22 U	0.27 U	**0.48 =**	**12 J**	**13 J**	**15 J**	**5.9 J**	**6.6 J**	**15 J**	**39 J**	**7.3 J**	**12 J**	**10 J**	**18 J**		920
Lead, Total	**15 =**	**86 =**	**6 =**	**2.7 =**	**11 J**	**20 J**	**24 J**	**29 J**	**57 J**	**27 J**	**100 J**	**740 J**	**22 J**	**20 J**	**40 J**		550
Nickel, Total	**2.7 =**	**2.8 =**	**5.7 =**	**6.1 =**	**8.1 =**	**15 =**	**17 =**	**7.8 =**	**16 =**	**19 =**	**10 =**	**15 =**	**9.8 =**	**8.5 =**	**23 =**		4000
Selenium, Total	0.12 U	0.12 U	0.13 U	0.13 U	4.5 UJ	5.6 UJ	5.2 UJ	4.9 UJ	5.3 UJ	5.7 UJ	4.7 UJ	4.7 UJ	5.1 UJ	5.5 UJ	5.3 UJ		3.5
Thallium, Total	**0.06 =**	**0.07 =**	**0.09 =**	**0.04 =**	4.5 U	5.6 U	5.2 U	4.9 U	5.2 U	5.7 U	4.7 U	4.7 U	5.1 U	5.5 U	5.3 U		3.3
Zinc, Total	**5.6 =**	**7.2 =**	**5.5 =**	**4.6 =**	**40 J**	**33 J**	**46 J**	**36 J**	**57 J**	**41 J**	**200 J**	**56 J**	**32 J**	**27 J**	**34 J**		28640
Cyanide, Total	0.24 U	0.24 U	0.24 U	0.27 U	0.2 U	0.2 U	0.2 U	**0.2 =**	0.2 U	0.2 U	0.2 U	**0.3 =**	0.2 U	**0.6 =**	0.2 U		40

results are in mg/kg or ppm
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)
Yellow Highlighted and bolded font exceeds Groundwater Protection Standard Soil Screening Levels (GWPS SSL)

Table A-3
SMA 4 - Mineral Wool Pile
Chemicals of Potential Concern - ERP Coke

Chemical, mg/kg	WC-MWP 01-06		WC-MWP 01-1224		WC-MWP 02-06		WC-MWP 02-1224		WC-MWP 03-06		WC-MWP 03-1224		WC-MWP 04-06		WC-MWP 04-1224	
Volatile Organics																
Acetone	0.0023	U	0.0035	U	0.0029	U	0.0034	U	0.0033	U	0.0033	U	0.0038	U	0.0027	U
	0.0069	U	0.0069	U	0.0049	U	**0.0046**	**J**	0.0066	U	0.0066	U	0.0065	U	0.0054	U
cis-1,2-Dichloroethene	0.00032	U	0.0049	U	0.0004	U	0.00047	U	0.00046	U	0.00046	U	0.00054	U	0.00038	U
	0.0015	**J**	0.0013	U	0.00091	U	0.00081	U	0.0012	U	0.0012	U	0.0012	U	0.001	U
Methylene Chloride	0.00031	U	0.00047	U	0.00039	U	0.00045	U	0.00044	U	0.00044	U	0.00051	U	0.00036	U
	0.0016	U	0.0016	U	0.0011	U	0.001	U	**0.0021**	**JB**	**0.0020**	**J**	0.0015	U	0.0036	
Trichloroethene	0.0003	U	0.00046	U	0.00038	U	0.00044	U	0.00043	U	0.00043	U	0.0005	U	0.00035	U
	0.0014	**J**	0.0012	U	0.00086	U	0.00076	U	0.0012	U	0.0011	U	0.0011	U	0.00095	U
Tetrachloroethene	0.00031	U	0.00047	U	0.00039	U	0.00046	U	0.00044	U	0.00045	U	0.00052	U	0.00036	U
	0.0021	**J**	**0.0015**	**J**	0.0011	U	0.00097	U	0.0015	U	0.0015	U	0.0014	U	0.0012	U
Xylenes, Total	0.001	U	0.0016	U	0.0013	U	0.0015	U	0.0015	U	0.0015	U	0.0017	U	0.0012	U
	0.001	U	**0.0011**	**J**	0.00074	U	0.00066	U	0.001	U	0.00099	U	0.00099	U	0.00099	J
Semivolatile Organics																
Benzo(a)pyrene	0.0067	U	**0.18**		0.0075	U	**0.058**	**J**	0.007	U	0.0078	U	0.0082	U	0.0074	U
	0.170	U	**.190**	U	0.190	U	0.200	U	0.170	U	0.200	U	0.180	U	0.180	U
Benzo(a)anthracene	0.0084	U	**0.2**		0.0095	U	**0.075**	**J**	0.0086	U	0.0098	U	0.010	U	0.0093	U
	0.0170	U	**0.190**	U	0.190	U	0.200	U	0.170	U	0.200	U	0.180	U	0.180	U
Benzo(b)fluoranthene	0.011	U	**0.22**		0.012	U	**0.074**	**J**	0.011	U	0.012	U	0.013	U	0.012	U
	0.036	U	**0.110**	**J**	0.039	U	0.041	U	0.035	U	0.040	U	0.038	U	0.037	U
Chrysene	**0.0092**	**J**	**0.23**		0.009	U	**0.076**	**J**	0.0084	U	0.0093	U	0.0097	U	0.0088	U
	0.038	U	**0.160**	**J**	0.041	U	0.043	U	0.038	U	0.043	U	0.040	U	0.039	U
Dibenz(a,h)anthracene	0.0075	U	**0.065**	**J**	0.0084	U	0.0093	U	0.0078	U	0.0087	U	0.0091	U	0.0082	U
	0.046	U	0.050	U	0.050	U	0.053	U	0.046	U	0.052	U	0.049	U	0.048	U
Indeno(1,2,3-cd)pyrene	0.0069	U	**0.08**		0.0078	U	0.0086	U	0.0072	U	0.008	U	0.0084	U	0.0076	U
	0.040	U	**0.058**	**J**	0.044	U	0.046	U	0.040	U	0.045	U	0.043	U	0.041	U
Acenaphthalene	0.0077	U	**0.013**	**J**	0.0086	U	0.008	U	0.008	U	0.0089	U	0.0093	U	0.0085	U
	0.180	U	0.190	U	0.190	U	0.200	U	0.180	U	0.200	U	0.190	U	0.180	U
Anthracene	0.0066	U	**0.053**	**J**	0.0074	U	**0.016**	**J**	0.0069	U	0.0076	U	0.008	U	0.0072	U
	0.180	U	0.190	U	0.190	U	0.200	U	0.180	U	0.200	U	0.190	U	0.180	U
Benzo(g,hi)perylene	0.0067	U	**0.15**		0.0075	U	**0.043**	**J**	0.007	U	0.0078	U	0.0081	U	0.0074	U
	0.045	U	**0.090**	**J**	0.049	U	0.052	U	0.045	U	0.390	U	0.048	U	0.047	U
Carbazole	0.0062	U	**0.019**	**J**	0.007	U	0.0077	U	0.0065	U	0.0072	U	0.0075	U	0.0068	U
	0.046	U	0.050	U	0.050	U	0.053	U	0.046	U	0.052	U	0.049	U	0.048	U
Fluoranthene	**0.0084**	**J**	**0.12**		0.0081	U	**0.042**	**J**	0.0075	U	0.0084	U	0.0087	U	0.0079	U
	0.050	U	**0.080**	**J**	0.055	U	0.058	U	0.050	U	0.057	U	0.054	U	0.052	U
2-Methylnapthalene	0.0061	U	**0.073**	**J**	0.0068	U	**0.019**	**J**	0.0063	U	0.007	U	0.0073	U	0.0067	U
	0.190	U	0.210	U	0.210	U	0.220	U	0.190	U	0.220	U	.220	U	0.200	U
Napthalene	0.0058	U	**0.040**	**J**	0.0065	U	0.0072	U	0.0061	U	0.0067	U	0.007	U	0.0064	U
	0.036	U	0.039	U	0.039	U	0.041	U	0.035	U	0.040	U	0.038	U	0.037	U
Phenanthrene	0.011	U	**0.19**		0.012	U	**0.060**	**J**	0.011	U	0.012	U	0.013	U	0.012	U
	0.170	U	0.180	U	0.180	U	0.190	U	0.170	U	0.190	U	0.180	U	0.170	U
Pyrene	**0.0074**	**J**	**0.18**		0.0076	U	**0.053**	**J**	0.0071	U	0.0079	U	0.0082	U	0.0075	U
	0.220	U	0.160	U	0.160	U	0.170	U	0.150	U	0.170	U	0.160	U	0.150	U
Inorganics																
Arsenic	**0.11**		**0.92**		**0.7**		**1.7**		**0.16**		**0.19**		**0.33**		**0.058**	**J**
	2.4		**4.2**		**2.4**		**3.5**		**2.2**		**2.2**		**2.0**		**2.3**	
Barium	**460**	**B**	**380**	**B**	**360**	**B**	**380**	**B**	**370**	**B**	**370**	**B**	**390**	**B**	**360**	**B**
	400		**350**		**330**		**330**		**350**		**330**		**380**		**320**	
Cadmium	**1.0**		**0.89**		**1.2**		**1.5**		**1.3**		**1.3**		**1.3**		**1.4**	
	0.11	J	0.10	U	0.098	U	0.11	U	0.095	U	0.10	U	0.10	J	0.089	U
Chromium	**33**	**B**	**47**	**B**	**26**	**B**	**29**	**B**	**26**	**B**	**26**	**B**	**25**	**B**	**35**	**B**
	33		**41**		**29**		**30**		**28**		**25**		**23**		**34**	
Lead	**0.95**	**B**	**1.4**	**B**	**2.3**	**B**	**4.7**	**B**	1.5	**B**	**0.93**	**B**	**1.3**	**B**	**0.82**	**B**
	2.6	U	2.9	U	2.7	U	**4.7**		2.7	U	2.8	U	2.7	U	2.5	U
Selenium	**0.71**		**1.3**		**1.6**		**2.3**		**1.0**		**0.91**		**0.88**		0.36	J
	1.5		**1.9**		**2.0**		**2.2**		**1.6**		**1.9**		**1.7**		**1.4**	
Silver	**0.15**		**0.15**		**0.19**		**0.23**		**0.18**		**0.19**		**0.18**		**0.19**	
	0.45	U	0.49	U	0.46	U	0.50	U	0.45	U	0.48	U	0.46	U	0.42	U
Cyanide	**3.1**		**1.1**		**2.0**		**3.0**		**3.0**		**2.1**		**3.9**		**3.0**	
	2.8		**2.0**		**2.9**		**2.8**		**2.8**		**1.5**		**2.7**		**1.7**	

Bold results are detected concentrations.

Results are in mg/kg or ppm

USEPA results taken from Sample Analysis Report Revision 5 - Sample Collection and Analysis at the ERP Coke Facility (dated January 23, Samples collected on May 17, 2012.

ERP Coke results (splits) are presented on the bottom line per analyte and not shaded.

ERP Coke results (splits) taken from TestAmerica Analytical Report document (dated June 1, 2012). Samples collected onMay 17, 2012.

Table A-4
Chemicals of Potential Concern (COPC)
SMA 4 Groundwater - ERP Coke

Chemical, µg/L	MW-49S 2/18/2014	MW-49S 5/14/2014	MW-49S 11/19/2014	MW-49S 5/20/2015	MW-49S 8/11/2015	MW-49S 11/10/2015	MW-49S 2/16/2016	MW-50 2/19/2014	MW-50 5/15/2014	MW-50 11/20/2014	MW-50 5/21/2015	MW-50 8/12/2015	MW-50 11/11/2015	MW-50 2/17/2016	MW-51 2/18/2014	MW-51 5/13/2014	MW-51 11/18/2014	MW-51 5/19/2015
Vinylchloride	22	5.30	10	16	69	70	0.710 j	0.100 u	0.370 j	2.100 j	0.100 u	1.900 j	0.100 u	1.700	330	230	260	220
Acetone	1.90 u	1.90 u	1.90 u	7.60 u	7.60 u	3.80 u	10 u	1.9 u	1.9 u	7.600 u	1.900 u	3.800 u	1.900 u	8.200 j	19 u	19 u	19 u	38 u
Methylene chloride	0.32 u	0.32 u	0.32 u	1.30 u	2.20 j b	0.64 u	0.40 j b	0.35 jb	0.32 u	1.300 u	0.320 u	0.640 u	0.320 u	0.320 u	3.20 u	3.20 u	3.20 u	6.40 u
Carbon disulfide	0.45 u	0.45 u	0.45 u	1.80 u	1.80 u	0.90 u	0.45 u	0.45 u	0.45 u	1.800 u	0.450 u	0.900 u	0.450 u	0.450 u	4.5 u	4.5 u	4.5 u	9 u
Methyl tert butyl ether	0.25 u	0.25 u	0.25 u	1 u	1 u	0.5 u	0.25 u	0.25 u	0.25 u	1 u	0.25 u	0.5 u	0.25 u	0.25 u	2.5 u	2.5 u	2.5 u	5 u
trans-1,2-Dichloroethene	0.15 u	0.15 u	0.15 u	0.60 u	0.72 j	0.30 u	0.15 u	0.15 u	0.15 u	0.6000 u	0.1500 u	0.3000 u	0.150 u	0.150 u	2 j	3.20 j	3.10 j	3 j
cis-1,2-Dichloroethene	3.20	1.30	0.57 j	15	88	14	0.17 j	0.15 u	0.15 u	0.6000 u	0.1800 j	0.3000 u	0.420 j	0.600 j	67	120	260	170
2-Butanone	2 u	2 u	2 u	8 u	8 u	4 u	2 u	2 u	2 u	8 u	2 u	4 u	2 u	2 u	20 u	20 u	20 u	40 u
Benzene	5.30	2.40	1.40	22	6	5.400	0.790 j	1.900	1.800	2.5 j	0.800 j	4.5	4.900	0.220 j	7.5 j	10	14	10 j
1,2-Dichloroethane	0.13 u	0.13 u	0.13 u	0.52 u	0.52 u	0.260 u	0.130 u	0.130 u	0.130 u	0.520 u	0.130 u	0.260 u	0.130 u	0.130 u	1.300 u	1.300 u	1.300 u	2.600 u
Trichloroethene	0.16 u	0.16 u	0.16 u	0.89 j	1.30 j	0.320 u	0.160 u	0.160 u	0.160 u	0.640 u	0.160 u	0.320 u	0.160 u	0.160 u	1.600 u	1.600 u	1.600 u	3.200 u
4-Methyl-2-pentanone	0.98 u	0.98 u	0.98 u	3.90 u	3.90 u	2 u	0.980 u	0.980 u	0.980 u	3.900 u	0.980 u	2 u	0.980 u	0.980 u	9.800 u	9.800 u	9.800 u	20 u
Toluene	0.17 u	0.20 j	0.18 j	72	0.810 j	0.620 j	0.290 j	0.170 u	0.170 u	0.680 u	0.170 u	0.340 u	0.25 j	0.170 u	1.700 u	1.700 u	1.800 j	3.400 u
Chlorobenzene	1.90	1.70	2.30	7.300	2.900 j	2.200	1.600	2.400	2.300	2.800 j	2.600	2.900	3.400	4.700	1.700 u	1.700 u	1.700 u	3.400 u
Ethylbenzene	0.16 u	0.16 u	0.16 u	0.640 u	0.640 u	0.320 u	0.160 u	0.160 u	0.160 u	0.640 u	0.160 u	0.320 u	0.160 u	0.160 u	1.600 u	1.600 u	1.600 u	3.200 u
m,p-Xylenes	0.34 u	0.34 u	0.34 u	1.400 u	1.400 u	0.680 u	0.340 u	0.340 u	0.340 u	1.400 u	0.340 u	0.680 u	0.340 u	0.340 u	3.400 u	3.400 u	3.400 u	6.800 u
o-Xylene	0.19 u	0.19 u	0.19 u	1.100 j	0.760 u	0.380 u	0.190 u	0.190 u	0.190 u	0.760 u	0.190 u	0.380 u	0.190 u	0.190 u	1.900 u	1.900 u	1.900 u	3.800 u
Styrene	0.17 u	0.17 u	0.17 u	0.680 u	0.680 u	0.340 u	0.170 u	0.170 u	0.170 u	0.680 u	0.170 u	0.340 u	0.170 u	0.170 u	1.700 u	1.700 u	1.700 u	3.400 u
Isopropylbenzene (Cumene)	0.19 u	0.19 u	0.19 u	0.760 u	0.760 u	0.380 u	0.190 u	0.190 u	0.190 u	0.760 u	0.190 u	0.380 u	0.190 u	0.190 u	1.900 u	1.900 u	1.900 u	3.800 u
1,4-Dioxane	1.60 u	1.60 u	1.60 u	1.600 u	230 u	110 u	57 u	1.600 u	1.600 u	230 u	57 u	110 u	57 u	57 u	1.800 j	570 u	570 u	1100 u
Cyclohexane, Methyl-	0.36 u	0.36 u	0.36 u	1.400 u		0.72 u	0.36 u	0.360 u	0.360 u	1.400 u	0.360 u	0.720 u	0.36 u	0.36 u	3.60 u	3.600 u	3.600 u	7.200 u
3/4-Methylphenol	0.24 u	0.24 u	0.24 u	0.850 j				0.240 u	0.240 u	0.240 u	0.240 u				0.24 u	0.240 u	0.240 u	0.240 u
1,2,4-Trichlorobenzene	0.27 u	0.27 u	0.27 u	0.840 u	0.84 u	0.42 u	0.21 u	0.210 u	0.210 u	0.840 u	0.210 u	0.420 u	0.21 u	0.21 u	2.10 u	2.100 u	2.100 u	0.270 u
1,2-Dichlorobenzene	0.22 u	0.22 u	0.15 u	0.220 u	0.60 u	0.30 u	0.15 u	0.220 u	0.220 u	0.600 u	0.220 u	0.300 u	0.150 u	0.150 u	1.5 u	0.220 u	1.5 u	3 u
1,3-Dichlorobenzene	0.28 u	0.13 u	0.13 u	0.520 u				0.280 u	0.130 u	0.280 u	0.130 u				0.280 u	1.300 u	1.300 u	2.600 u
1,4-Dichlorobenzene	0.30 u	0.16 u	0.30 u	0.310 u				0.300 u	0.160 u	0.640 u	0.160 u				0.300 u	1.600 u	0.300 u	0.310 u
2,4-Dimethylphenol	0.55 u	0.55 u	0.55 u	0.550 u				0.550 u	0.550 u	0.550 u	0.550 u				0.550 u	0.550 u	0.550 u	0.550 u
2-Chlorophenol	1.90 u	1.90 u	1.90 u	1.90 u				1.900 u	1.900 u	1.900 u	1.900 u				1.90 u	1.90 u	1.90 u	1.90 u
2-Methylphenol	0.93 u	0.93 u	0.93 u	1.10 j				0.930 u	0.930 u	0.930 u	0.930 u				0.93 u	0.93 u	0.93 u	0.93 u
Acetophenone	0.23 u	0.23 u	0.23 u	0.23 u				0.230 u	0.230 u	0.230 u	0.230 u				0.23 u	0.23 u	0.23 u	0.23 u
Benzyl alcohol	0.22 u	0.22 u	0.22 u	0.22 u				0.220 u	0.220 u	0.220 u	0.220 u				0.22 u	0.22 u	0.22 u	0.22 u
Carbazole	0.41 u	0.41 u	0.41 u	0.41 u				0.410 u	0.410 u	0.410 u	0.410 u				0.41 u	0.41 u	0.41 u	0.41 u
Dibenzofuran	0.27 u	0.28 u	0.28 u	0.28 u				0.270 u	0.280 u	0.270 u	0.280 u				0.28 u	0.27 u	0.28 u	0.28 u
Dimethyl phthalate	0.20 u	0.20 u	0.20 u	0.20 u				0.200 u	0.200 u	0.200 u	0.200 u				0.20 u	0.20 u	0.20 u	0.20 u
Pentachlorophenol	19 u	19 u	19 u	19 u				19 u	19 u	19 u	19 u				19 u	19 u	19 u	19 u
Phenol	1.90 u	1.90 u	1.90 u	3.40 j				1.900 u	1.900 u	2.700 j	4.700 j				1.90 u	2.90 j	1.90 u	3.20 j
Pyrene	0.0076 u	0.008 u	0.0077 u	0.0077 u				0.0078 u	0.0077 u	0.0077 u	0.0077 u				0.0076 u	0.021 j	0.039 j	0.027 j
Naphthalene										0.0049 u	0.0049 u				0.0049 u	0.0049 u	0.0049 u	0.0049 u
2-Methylnaphthalene	0.0320 j	0.0320 j	0.01 u	0.0410 j				0.01 u	0.01 u	0.01 u	0.01 u				0.84	0.93	1.40	1.10
Acenaphthene	0.0094 u	0.0098 u	0.0095 u	0.0095 u				0.0096 u	0.0094 u	0.0094 u	0.0094 u				0.038 j	0.036 j	0.0095 u	0.0095 u
Acenaphthylene[2]	0.0130 u	0.0140 u	0.014 u	0.014 u				0.014 u	0.013 u	0.013 u	0.013 u				0.034 j	0.054 j	0.063 j	0.047 j
Anthracene	0.0030 u	0.0032 u	0.0031 u	0.0031 u				0.0031 u	0.003 u	0.003 u	0.003 u				0.003 u	0.0031 u	0.0031 u	0.0031 u
Benzo(a)anthracene	0.0049 u	0.0051 u	0.0049 u	0.0049 u				0.005 u	0.0049 u	0.0049 u	0.0049 u				0.0049 u	0.0049 u	0.0049 u	0.0049 u
Benzo(a)pyrene	0.0033 u	0.0034 u	0.0033 u	0.0033 u				0.0033 u	0.0033 u	0.0033 u	0.0033 u				0.0033 u	0.0033 u	0.0033 u	0.0033 u
Benzo(b)fluoranthene	0.0034 u	0.0035 u	0.0034 u	0.0034 u				0.0034 u	0.0034 u	0.0034 u	0.0034 u				0.0034 u	0.0034 u	0.0034 u	0.0034 u
Benzo(g,h,i)perylene[2]	0.0048 u	0.0050 u	0.0048 u	0.0048 u				0.0049 u	0.0048 u	0.0048 u	0.0048 u				0.0048 u	0.0048 u	0.0048 u	0.0048 u
Benzo(k)fluoranthene	0.0030 u	0.0031 u	0.003 u	0.003 u				0.0031 u	0.003 u	0.003 u	0.003 u				0.003 u	0.003 u	0.0031 u	0.0031 u
Chrysene	0.0046 u	0.0048 u	0.0046 u	0.0046 u				0.0046 u	0.0046 u	0.0046 u	0.0046 u				0.0046 u	0.0046 u	0.0046 u	0.0046 u
Dibenz(a,h)anthracene	0.0043 u	0.0045 u	0.0043 u	0.0043 u				0.0044 u	0.0043 u	0.0043 u	0.0043 u				0.0043 u	0.036 j	0.071 j	0.051 j
Fluoranthene	0.0180 u	0.0190 u	0.018 u	0.018 u				0.0180 u	0.0180 u	0.0180 u	0.0180 u				0.024 j	0.043 j	0.040 j	0.032 j
Fluorene	0.014 u	0.015 u	0.014 u	0.014 u				0.014 u	0.014 u	0.014 u	0.014 u				0.014 u	0.014 u	0.014 u	0.014 u
Indeno(1,2,3-cd)pyrene	1.60 u	1.60 u	1.60 u	6.60 u	6.60 u	3.30 u	1.60 u	1.60 u	1.60 u	6.60 u	1.60 u	3.30 u	1.600 u	1.600 u	16 u	16 u	16 u	33 u
Methyl Acetate					1.10 u	0.56 u	0.28 u					0.56 u	0.280 u	0.280 u				
Cyclohexane																		

results are in ug/kg or ppb
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)

Table A-4
Chemicals of Potential Concern (COPC)
SMA 4 Groundwater - ERP Coke

Chemical, µg/L	MW-51 8/10/2015	MW-51 11/10/2015	MW-51 2/16/2016	MW-52 2/18/2014	MW-52 5/14/2014	MW-52 11/19/2014	MW-52 5/20/2015	MW-52 8/11/2015	MW-52 11/10/2015	MW-52 2/16/2016	MW-53 2/18/2014	MW-53 5/13/2014	MW-53 11/18/2014	MW-53 5/19/2015	MW-53 8/10/2015	MW-53 11/10/2015	MW-53 2/16/2016	MW-54 2/18/2014
Vinylchloride	**91**	**170**	**43**	0.100 u	**0.130 j**	**1.700**	**0.290 j**	**0.210 j**	**3.3000**	**0.5600 j**	**3**	**1.800**	**0.850 j**	**1.200**	**0.580 j**	**0.890 j**	**0.910 j**	4 u
Acetone	19 u	19 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	**6.5 jb**	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	76 u
Methylene chloride	**7.60 j b**	3.20 u	**0.390 j b**	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	**0.390 j b**	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	**0.460 j b**	13 u
Carbon disulfide	4.5 u	4.5 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	18 u
Methyl tert butyl ether	2.5 u	2.5 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	**0.2800 j**	**0.2600 j**	0.25 u	0.25 u	0.25 u	0.25 u	**0.270 j**	10 u
trans-1,2-Dichloroethene	**1.800 j**	**2.400 j**	**0.820 j**	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	**0.160 j**	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	6 u
cis-1,2-Dichloroethene	**88**	**150**	**5**	0.1500 u	0.1500 u	**3.200**	**0.170 j**	**0.360 j**	**6.300**	**0.620 j**	**0.190 j**	**0.230 j**	**0.150 j**	**0.170 j**	0.150 u	0.150 u	0.150 u	6 u
2-Butanone	20 u	20 u	2 u	2 u	2 u	2 u	2 u	**2.5 j**	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	80 u
Benzene	**8 j**	**12**	**3.600**	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.1600 u	**3.5**	5	**4.9000**	**2.2000**	**0.3500 j**	**1.4000**	**0.75 j**	6.40 u
1,2-Dichloroethane	1.300 u	1.300 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.1300 u	0.1300 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	5.20 u
Trichloroethene	1.600 u	1.600 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.1600 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	6.40 u
4-Methyl-2-pentanone	9.800 u	9.800 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.9800 u	0.9800 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	39 u
Toluene	10 u	1.70 u	0.17 u	0.17 u	0.17 u	0.170 u	0.170 u	0.170 u	**0.2400 j**	0.1700 u	**0.210 j**	**0.180 j**	0.170 u	0.170 u	0.170 u	**0.25 j**	0.170 u	6.80 u
Chlorobenzene	1.70 u	1.70 u	**0.68 j**	**1.80**	**2.20**	**2.100**	**1.700**	**1.700**	**1.6000**	**1.5**	**12**	**12**	**10**	**11**	**8.900**	**8.5**	**8.100**	**990**
Ethylbenzene	1.60 u	1.60 u	0.16 u	0.16 u	0.16 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.160 u	0.160 u	**0.25 j**	**0.220 j**	0.160 u	0.160 u	0.160 u	0.160 u	6.40 u
m,p-Xylenes	3.40 u	3.40 u	0.34 u	0.34 u	0.34 u	0.340 u	0.340 u	0.340 u	0.3400 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	14 u
o-Xylene	10 u	1.900 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	7.600 u
Styrene	**2.10 j**	1.70 u	0.17 u	0.17 u	0.17 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	6.800 u
Isopropylbenzene (Cumene)	10 u	1.900 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	**0.190 j**	0.190 u	0.190 u	0.190 u	7.600 u
1,4-Dioxane	570 u	570 u	57 u	57 u	**3.30 j**	57 u	57 u	57 u	57 u	57 u	57 u	1.600 u	1.600 u	1.600 u	57 u	57 u	57 u	1.60 u
Cyclohexane, Methyl-	10 u	3.60 u	**0.36 j**	0.36 u	0.36 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	14 u
3/4-Methylphenol				**0.290 j**	**0.300 j**	0.240 u	**0.350 j**				0.240 u	**0.360 j**	**0.340 j**	0.240 u				0.240 u
1,2,4-Trichlorobenzene	**2.10 u**	**2.10 u**	**0.21 u**	**0.21 u**	**0.21 u**	**0.210 u**	**0.270 u**	**0.210 u**	**0.210 u**	**0.210 u**	**0.270 u**	**0.270 u**	**0.270 u**	**0.270 u**	**0.21 u**	**0.21 u**	**0.21 u**	**8.40 u**
1,2-Dichlorobenzene	1.5 u	1.5 u	0.150 u	0.150 u	0.150 u	0.150 u	0.220 u	0.150 u	0.150 u	0.150 u	0.220 u	0.150 u	0.150 u	0.150 u	0.15 u	0.15 u	0.15 u	6 u
1,3-Dichlorobenzene				**0.130 u**	**0.280 u**	**0.290 u**	**0.130 u**				**0.290 u**	**0.210 j**	**0.220 j**	**0.280 u**				**0.280 u**
1,4-Dichlorobenzene				0.300 u	0.300 u	0.300 u	0.310 u				**0.200 j**	**0.270 j**	**0.290 j**	**0.200 j**				0.300 u
2,4-Dimethylphenol				0.550 u	0.550 u	0.550 u	0.560 u				0.55 u	0.55 u	0.55 u	0.55 u				0.550 u
2-Chlorophenol				1.90 u	1.90 u	1.90 u	1.90 u				1.90 u	1.90 u	1.90 u	1.90 u				1.90 u
2-Methylphenol				0.93 u	0.93 u	0.93 u	0.94 u				0.93 u	0.93 u	0.93 u	0.93 u				0.93 u
Acetophenone				0.230 u	0.230 u	0.230 u	0.230 u				0.23 u	0.23 u	0.23 u	0.23 u				0.23 u
Benzyl alcohol				0.220 u	0.220 u	0.220 u	0.220 u				0.22 u	0.22 u	0.22 u	0.22 u				0.22 u
Carbazole				0.410 u	0.410 u	0.410 u	0.410 u				0.41 u	0.41 u	0.41 u	0.41 u				0.41 u
Dibenzofuran				0.280 u	0.280 u	0.280 u	0.280 u				0.28 u	**0.33 j**	0.28 u	0.28 u				0.28 u
Dimethyl phthalate				0.200 u	0.200 u	0.200 u	0.200 u				0.20 u	**0.42 jb**	0.20 u	0.20 u				0.20 u
Pentachlorophenol				19 u	19 u	19 u	19 u				19 u	19 u	19 u	19 u				19 u
Phenol				1.90 u	1.90 u	1.9 u	1.9 u				1.90 u	1.90 u	**5.80 j**	1.90 u				1.90 u
Pyrene				0.0077 u	0.0077 u	0.0077 u	0.0077 u				**0.10**	**0.08 j**	**0.11**	**0.088 j**				**1.300**
Naphthalene				0.0051 u	0.0051 u	0.0051 u	**0.0160 j**				0.0051 u	**0.009 j**	0.0051 u	0.0051 u				**0.039 j**
2-Methylnaphthalene				0.0049 u	0.0049 u	0.0049 u	0.0049 u				0.0049 u	0.0049 u	0.0049 u	0.0049 u				**0.015 j**
Acenaphthene				**0.380**	**0.540**	**0.920**	**0.390**				**9.5**	**7.40**	**7.60**	**7.80**				**14**
Acenaphthylene[2]				0.0095 u	0.0094 u	0.0095 u	0.0095 u				0.0095 u	**0.11**	**0.10**	**0.10**				0.0094 u
Anthracene				0.014 u	0.013 u	0.014 u	0.013 u				0.013 u	**0.059 j**	0.014 u	**0.040 j**				**0.220**
Benzo(a)anthracene				0.0031 u	0.003 u	0.0031 u	0.0031 u				0.003 u	0.0031 u	0.0031 u	0.0031 u				**0.220**
Benzo(a)pyrene				0.0049 u	0.0049 u	0.0049 u	0.0049 u				0.0049 u	0.0049 u	0.0049 u	0.0049 u				**0.028 j**
Benzo(b)fluoranthene				0.0033 u	0.0033 u	0.0033 u	0.0033 u				0.0033 u	0.0033 u	0.0033 u	0.0033 u				**0.056 j**
Benzo(g,h,i)perylene[2]				0.0034 u	0.0034 u	0.0034 u	0.0034 u				0.0034 u	0.0034 u	0.0034 u	0.0034 u				**0.0074 j**
Benzo(k)fluoranthene				0.0048 u	0.0048 u	0.0048 u	0.0048 u				0.0048 u	0.0048 u	0.0048 u	0.0048 u				**0.023 j**
Chrysene				0.003 u	0.003 u	0.003 u	0.003 u				0.003 u	0.003 u	0.003 u	0.003 u				**0.160**
Dibenz(a,h)anthracene				0.0046 u	0.0046 u	0.0046 u	0.0046 u				0.0046 u	0.0046 u	0.0046 u	0.0046 u				0.0046 u
Fluoranthene				0.0043 u	0.0043 u	0.0043 u	0.0043 u				**0.230**	**0.170**	**0.230**	**0.190**				**2**
Fluorene				0.018 u	0.018 u	0.018 u	0.018 u				**1.100**	**0.880**	**0.590**	**0.410**				**0.220**
Indeno(1,2,3-cd)pyrene	16 u	16 u	1.600 u	0.014 u	0.014 u	0.014 u	0.014 u				0.014 u	0.014 u	0.014 u	0.014 u				0.014 u
Methyl Acetate	20 u	2.80 u	**0.5 j**	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	66 u
Cyclohexane								0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	11 u

results are in ug/kg or ppb
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)

Table A-4
Chemicals of Potential Concern (COPC)
SMA 4 Groundwater - ERP Coke

Chemical, µg/L	MW-54 5/13/2014	MW-54 11/18/2014	MW-54 5/19/2015	MW-54 8/11/2015	MW-54 11/10/2015	MW-54 2/17/2016	MW-55 2/18/2014	MW-55 5/14/2014	MW-55 11/19/2014	MW-55 5/20/2015	MW-55 8/11/2015	MW-55 11/10/2015	MW-55 2/16/2016	MW-56 2/19/2014	MW-56 11/19/2014	MW-56 5/20/2015	MW-56 8/11/2015	MW-56 11/11/2015
Vinylchloride	10 u	5 u	10 u	4 u	2 u	1 u	400 u	800 u	400 u	400 u	400 u	1000 u	200 u	50 u	20 u	10 u	20 u	10 u
Acetone	190 u	95 u	190 u	76 u	38 u	19 u	7600 u	15000 u	7600 u	7600 u	**13000 j b**	19000 u	3800 u	**1600 jb**	380 u	190 u	380 u	190 u
Methylene chloride	32 u	16 u	32 u	**25 j b**	6.4 u	**4 j b**	1300 u	2600 u	1300 u	1300 u	1300 u	3200 u	**830 j b**	**450 jb**	64 u	32 u	**120 j b**	32 u
Carbon disulfide	45 u	23 u	45 u	18 u	9 u	4.5 u	1800 u	3600 u	1800 u	1800 u	1800 u	4500 u	900 u	230 u	90 u	45 u	90 u	45 u
Methyl tert butyl ether	25 u	13 u	25 u	10 u	5 u	2.5 u	1000 u	2000 u	1000 u	1000 u	1000 u	2500 u	500 u	130 u	50 u	25 u	50 u	25 u
trans-1,2-Dichloroethene	15 u	7.5 u	15 u	6 u	3 u	1.5 u	600 u	1200 u	600 u	600 u	600 u	1500 u	300 u	75 u	30 u	15 u	30 u	15 u
cis-1,2-Dichloroethene	**20 j**	7.5 u	15 u	6 u	3 u	1.5 u	600 u	1200 u	600 u	600 u	600 u	1500 u	300 u	75 u	30 u	15 u	30 u	15 u
2-Butanone	200 u	100 u	200 u	80 u	40 u	20 u	8000 u	16000 u	8000 u	8000 u	8000 u	20000 u	4000 u	1000 u	400 u	200 u	400 u	200 u
Benzene	**35 j**	8 u	**80 j**	6.40 u	3.20 u	1.60 u	**42000**	**61000**	**49000**	**58000**	**59000**	**46000**	**53000**	**14000**	**8700**	**82 j**	**250**	**1600**
1,2-Dichloroethane	13 u	6.5 u	13 u	5.20 u	2.60 u	1.30 u	520 u	1000 u	520 u	520 u	520 u	1300 u	260 u	65 u	26 u	13 u	26 u	**75 j**
Trichloroethene	**20 j**	8 u	16 u	6.40 u	3.20 u	1.60 u	640 u	1300 u	640 u	640 u	640 u	1600 u	320 u	80 u	32 u	16 u	32 u	16 u
4-Methyl-2-pentanone	98 u	49 u	98 u	39 u	20 u	9.80 u	3900 u	7800 u	3900 u	3900 u	3900 u	9800 u	2000 u	490 u	200 u	98 u	200 u	98 u
Toluene	**74 j**	8.5 u	17 u	6.80 u	3.40 u	1.70 u	**42000**	**56000**	**46000**	**35000**	**45000**	**43000**	**28000**	85 u	**510**	17 u	34 u	**30 j**
Chlorobenzene	**1500**	**970**	**2300**	**1000**	**560**	**470**	**140000**	**160000**	**130000**	**120000**	**140000**	**130000**	**110000**	**3900**	**3800**	**1700**	**3000**	**2600**
Ethylbenzene	16 u	8 u	16 u	6.40 u	3.20 u	1.60 u	640 u	1300 u	640 u	640 u	640 u	1600 u	320 u	80 u	32 u	16 u	32 u	16 u
m,p-Xylenes	**55 j**	17 u	34 u	14 u	6.80 u	3.40 u	1400 u	2700 u	1400 u	1400 u	1400 u	3400 u	**690 j**	170 u	68 u	34 u	68 u	34 u
o-Xylene	19 u	9.5 u	19 u	7.60 u	3.80 u	1.90 u	760 u	1500 u	760 u	760 u	760 u	1900 u	380 u	95 u	38 u	19 u	38 u	19 u
Styrene	17 u	8.5 u	17 u	6.80 u	3.40 u	1.70 u	680 u	1400 u	680 u	680 u	680 u	1700 u	340 u	85 u	34 u	17 u	34 u	17 u
Isopropylbenzene (Cumene)	19 u	9.5 u	19 u	7.60 u	3.80 u	1.90 u	760 u	1500 u	760 u	760 u	760 u	1900 u	380 u	95 u	38 u	19 u	38 u	19 u
1,4-Dioxane	1.60 u	2900 u	5700 u	2300 u	1100 u	570 u	1.60 u	460000 u	230000 u	1.60 u	230000 u	570000 u	110000 u	29000 u	1.600 u	5700 u	11000 u	5700 u
Cyclohexane, Methyl-	36 u	18 u	36 u	14 u	7.20 u	3.60 u	1400 u	2900 u	1400 u	1400 u		3600 u	720 u	180 u	72 u	36 u	72 u	36 u
3/4-Methylphenol	**2.400 j**	0.240 u	0.240 u				**42**	**40**	**29**	**23**				**2.60 j**	**3.20 j**	**1.30 j**		
1,2,4-Trichlorobenzene	**0.27 u**	**11 u**	**0.270 u**	**8.40 u**	**4.20 u**	**2.10 u**	**840 u**	**460**	**840 u**	**440**	**840 u**	**2100 u**	**420 u**	**110 u**	**0.270 u**	**0.270 u**	**42 u**	**21 u**
1,2-Dichlorobenzene	15 u	0.22 u	15 u	6 u	3 u	1.5 u	600 u	1200 u	**3.90**	**0.220** u	600 u	1500 u	300 u	75 u	30 u	15 u	30 u	15 u
1,3-Dichlorobenzene	**13 u**	**6.5 u**	**0.290 u**				**6.70 j**	**7 j**	**8.40 j**	**0.29 u**				**65 u**	**0.280 u**	**13 u**		
1,4-Dichlorobenzene	16 u	0.300 u	0.310 u				640 u	**420**	**430**	**560**				**5.200 j**	**1.900 j**	16 u		
2,4-Dimethylphenol	0.550 u	0.550 u	0.550 u				**1.10 j**	**0.99 j**	0.55 u	**0.840 j**				2.200 u	**1 j**	0.56 u		
2-Chlorophenol	1.90 u	**1.90 j**	1.90 u				**39**	**26**	**17**	**21**				7.600 u	1.900 u	1.900 u		
2-Methylphenol	0.93 u	0.93 u	0.94 u				**28**	**30**	**14**	**15**				3.700 u	**3.600 j**	0.940 u		
Acetophenone	0.23 u	0.23 u	0.23 u				0.23 u	**4.20 j**	**3.10 j**	**4.20 j**				0.910 u	0.230 u	0.230 u		
Benzyl alcohol	0.22 u	0.22 u	0.22 u				**1.600 j**	**1.5 j**	**0.66 j**	0.22 u				0.870 u	0.220 u	0.220 u		
Carbazole	0.41 u	0.41 u	0.41 u				**1.100 j**	**1.30 j**	**1.30 j**	**1.40 j**				1.600 u	**0.440 j**	0.410 u		
Dibenzofuran	0.28 u	0.27 u	0.28 u				**0.810 j**	**1 j**	**1.200 j**	**1.30 j**				**3.700 j**	**3.400 j**	**1.700 j**		
Dimethyl phthalate	0.20 u	0.20 u	0.20 u				0.200 u	0.200 u	0.200 u	0.20 u				0.800 u	0.200 u	0.200 u		
Pentachlorophenol	19 u	19 u	19 u				19 u	19 u	19 u	19 u				76 u	19 u	**21 j**		
Phenol	**3.70 j**	1.90 u	1.90 u				**170**	**270**	**87**	**130**				**18 j**	**13**	**8.70 j**		
Pyrene	**1**	**1.20**	**1**				**0.24**	**0.29**	**0.23**	**0.210**				**1**	**0.310**	**0.25**		
Naphthalene	**0.120**	0.005 u	0.0051 u				**22**	**22**	**29**	**30**				**8.10**	**17**	**1.30**		
2-Methylnaphthalene	**0.012 j**	**0.044 j**	0.0049 u				**1.10**	**1.40**	**1.40**	**1.40**				**0.63**	**0.560**	**0.04 j**		
Acenaphthene	**13**	**10**	**11**				**0.69**	**0.83**	**0.78**	**0.81**				**4.90**	**6.700**	**4.40**		
Acenaphthylene[2]	**0.09**	**0.08 j**	0.0095 u				**0.06 j**	**0.07 j**	**0.08 j**	**0.09 j**				**0.16**	**0.049 j**	0.0094 u		
Anthracene	**0.21**	**0.24**	**0.200**				**0.25**	**0.320**	**0.300**	**0.23**				**0.59**	**0.360**	**0.190**		
Benzo(a)anthracene	**0.21**	**0.28**	**0.180**				**0.048 j**	**0.0470 j**	0.003 u	**0.03 j**				**0.53**	**0.052 j**	**0.016 j**		
Benzo(a)pyrene	**0.05 j**	**0.13**	**0.030 j b**				**0.021 j**	**0.0190 j**	0.0049 u	**0.02 j**				**0.5**	**0.047 j**	**0.012 j**		
Benzo(b)fluoranthene	**0.09 j**	**0.23**	**0.058 j b**				**0.028 j**	**0.0280 j**	0.0033 u	**0.021 j**				**0.650**	**0.057 j**	**0.016 j**		
Benzo(g,h,i)perylene[2]	**0.023 j**	**0.083 j**	**0.017 j**				**0.01 j**	**0.0082 j**	0.0034 u	**0.0087 j**				**0.510**	**0.044 j**	**0.013 j**		
Benzo(k)fluoranthene	**0.026 j**	**0.083 j**	**0.016 j b**				**0.015 j**	**0.011 j**	0.0048 u	**0.0078 j**				**0.180**	**0.017 j**	0.0048 u		
Chrysene	**0.140**	**0.240**	**0.086 j**				**0.048 j**	**0.049 j**	0.003 u	**0.033 j**				**1**	**0.068 j**	**0.024 j**		
Dibenz(a,h)anthracene	**0.0066 j**	**0.02 j**	0.0046 u				0.0046 u	0.0046 u	0.0046 u	0.0046 u				**0.20**	0.0046 u	0.0046 u		
Fluoranthene	**1.40**	**1.70**	**1.30**				**0.470**	**0.5**	**0.430**	**0.37**				**1.40**	**0.55**	**0.43**		
Fluorene	**0.18**	**0.17**	0.02 u				**1.200**	**1.40**	**1.30**	**1.40**				**7**	**8.60**	**5.30**		
Indeno(1,2,3-cd)pyrene	0.024 j	**0.089 j**	**0.018 j**				0.014 u	0.014 u	0.014 u	0.014 u				**0.32**	**0.024 j**	0.014 u		
Methyl Acetate	160 u	82 u	160 u	66 u	33 u	16 u	6600 u	13000 u	6600 u	6600 u	6600 u	16000 u	3300 u	820 u	330 u	160 u	330 u	160 u
Cyclohexane	28 u	14 u	28 u	11 u	5.60 u	2.80 u	1100 u	2200 u	1100 u	1100 u	1100 u	2800 u	560 u	140 u	56 u	28 u	56 u	28 u

results are in ug/kg or ppb
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)

Table A-4
Chemicals of Potential Concern (COPC)
SMA 4 Groundwater - ERP Coke

Chemical, µg/L	MW-56 2/16/2016	MW-70 2/20/2014	MW-70 5/15/2014	MW-70 11/20/2014	MW-70 5/21/2015	MW-71 2/20/2014	MW-71 5/15/2014	MW-71 11/20/2014	MW-71 5/21/2015	MW-72 2/20/2014	MW-72 5/15/2014	MW-72 11/20/2014	MW-72 5/21/2015	MW-77 2/18/2014	MW-77 5/13/2014	MW-77 11/18/2014	MW-77 5/19/2015	MW-78 2/19/2014	MW-78 5/14/2014
Vinylchloride	20 u	0.100 u	0.100 u	0.100 u	0.100 u	0.100 u	0.100 u	0.100 u	0.100 u	0.100 u	0.100 u	**0.15 j**	0.10 u	0.100 u	0.100 u	0.100 u	0.100 u	0.100 u	**0.550 j**
Acetone	380 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	**2.300 j**	1.900 u	1.900 u	1.900 u	**2 j**	1.90 u	1.900 u	**7.300 jb**	1.900 u	1.900 u	**2.600 jb**	**7.600 jb**
Methylene chloride	**180 j b**	0.320 u	0.320 u	**5.300**	0.320 u	0.320 u	0.320 u	**4.600**	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	**0.320 jb**	0.320 u
Carbon disulfide	90 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u
Methyl tert butyl ether	50 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u
trans-1,2-Dichloroethene	30 u	0.15 u	0.15 u	0.15 u	0.15 u	0.15 u	0.15 u	0.15 u	0.15 u	0.15 u	0.15 u	0.15 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u
cis-1,2-Dichloroethene	30 u	0.15 u	0.15 u	0.15 u	0.15 u	0.15 u	0.15 u	0.15 u	0.15 u	**0.17 j**	**0.28 j**	**0.28 j**	**0.25 j**	0.150 u	0.150 u	0.150 u	0.150 u	**0.310 j**	**0.460 j**
2-Butanone	400 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u
Benzene	**6500**	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u
1,2-Dichloroethane	26 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u
Trichloroethene	32 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u
4-Methyl-2-pentanone	200 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u
Toluene	**34 j**	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u
Chlorobenzene	**3000**	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	**0.410 j**	**0.710 j**
Ethylbenzene	32 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u
m,p-Xylenes	68 u	0.3400 u	0.3400 u	0.3400 u	0.3400 u	0.3400 u	0.3400 u	0.3400 u	0.3400 u	0.3400 u	0.3400 u	0.3400 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u
o-Xylene	38 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u
Styrene	34 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u
Isopropylbenzene (Cumene)	38 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u
1,4-Dioxane	11000 u	57 u	57 u	57 u	57 u	1.600 u	57 u	57 u	57 u	1.60 u	1.60 u	1.60 u	1.600 u	57 u	1.600 u	57 u	1.600 u	1.600 u	1.600 u
Cyclohexane, Methyl-	72 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u	0.360 u
3/4-Methylphenol		0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	0.240 u	**0.700 j**
1,2,4-Trichlorobenzene	**42 u**	**0.270 u**	**0.210 u**	**0.270 u**	**0.210 u**	**0.270 u**	**0.210 u**	**0.210 u**	**0.210 u**	**0.270 u**	**0.270 u**	**0.210 u**	**0.210 u**	**0.210 u**	**0.270 u**	**0.270 u**	**0.270 u**	**0.270 u**	**2.100 j**
1,2-Dichlorobenzene	30 u	0.150 u	0.150 u	0.220 u	0.150 u	0.220 u	0.220 u	0.150 u	0.150 u	0.150 u	0.220 u	0.150 u	0.150 u	0.150 u	0.220 u	0.220 u	0.220 u	0.150 u	0.150 u
1,3-Dichlorobenzene		**0.130 u**	**0.290 u**	**0.130 u**	**0.290 u**	**0.130 u**	**0.130 u**	**0.130 u**	**0.290 u**	**0.280 u**	**0.290 u**	**0.290 u**	**0.130 u**	**0.130 u**	**0.130 u**	**0.280 u**	**0.280 u**	**0.270 j**	**0.200 j**
1,4-Dichlorobenzene		0.160 u	0.300 u	0.300 u	0.310 u	0.310 u	0.160 u	0.160 u	0.300 u	0.160 u	0.160 u	0.300 u	0.310 u	0.160 u	0.160 u	0.300 u	0.160 u	**0.590 j**	**2.600 j**
2,4-Dimethylphenol		0.550 u	0.550 u	0.550 u	0.550 u	0.550 u	0.550 u	0.550 u	0.550 u	0.550 u	0.550 u	0.550 u	0.560 u	0.550 u	0.550 u	0.550 u	0.550 u	0.550 u	0.550 u
2-Chlorophenol		1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u
2-Methylphenol		0.93 u	0.93 u	0.93 u	0.93 u	0.94 u	0.93 u	0.93 u	0.93 u	0.93 u	0.93 u	0.93 u	0.950 u	0.930 u	0.930 u	0.930 u	0.930 u	0.930 u	0.930 u
Acetophenone		0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	0.230 u	**0.340 j**
Benzyl alcohol		0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u	0.220 u
Carbazole		0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u	0.410 u
Dibenzofuran		0.270 u	0.280 u	0.280 u	0.280 u	0.280 u	0.280 u	0.270 u	0.280 u	0.270 u	0.280 u	0.280 u	0.280 u	0.280 u	0.280 u	0.280 u	0.270 u	0.280 u	0.270 u
Dimethyl phthalate		0.200 u	0.200 u	0.200 u	0.200 u	0.200 u	0.200 u	0.200 u	0.200 u	0.200 u	0.200 u	0.200 u	0.200 u	0.200 u	**0.530 jb**	0.200 u	0.200 u	0.200 u	0.200 u
Pentachlorophenol		19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u
Phenol		1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	1.90 u	**2 j**
Pyrene		0.0077 u	0.0077 u	0.0077 u	0.0077 u	**0.1**	0.0077 u	0.0077 u	0.0077 u	0.0077 u	0.0077 u	0.0077 u	0.0078 u	0.0078 u	0.0077 u	0.0077 u	0.0079 u	0.0077 u	0.0076 u
Naphthalene		0.0051 u	0.0051 u	0.0051 u	0.0051 u	0.005 u	0.0051 u	0.005 u	0.0051 u	**0.15**	0.0051 u	**0.180**	0.0051 u	0.0051 u	**0.0074 j**	0.0051 u	0.0052 u	0.0051 u	0.005 u
2-Methylnaphthalene		0.0049 u	0.0049 u	0.0049 u	0.0049 u	0.0049 u	0.0049 u	0.0049 u	0.0049 u	0.0049 u	0.0049 u	0.0049 u	0.005 u	0.0049 u	0.0049 u	0.0049 u	0.005 u	0.0049 u	0.0049 u
Acenaphthene		0.01 u	0.01 u	0.01 u	0.01 u	0.01 u	0.01 u	0.01 u	0.01 u	0.01 u	0.01 u	0.01 u	0.01 u	0.01 u	0.01 u	0.01 u	0.011 u	0.01 u	0.01 u
Acenaphthylene[2]		0.0094 u	0.0095 u	0.0094 u	0.0095 u	0.0094 u	0.0095 u	0.0094 u	0.0095 u	0.0095 u	0.0095 u	0.0094 u	0.0096 u	0.0096 u	0.0095 u	0.0094 u	0.0097 u	0.0095 u	0.0094 u
Anthracene		0.013 u	0.013 u	0.013 u	0.013 u	0.013 u	0.014 u	0.013 u	0.014 u	0.013 u	0.014 u	0.013 u	0.014 u	0.014 u	0.014 u	0.013 u	0.014 u	0.013 u	0.013 u
Benzo(a)anthracene		0.003 u	0.003 u	0.003 u	0.003 u	**0.098**	0.0031 u	0.003 u	0.0031 u	0.0031 u	0.0031 u	0.003 u	0.0031 u	0.0031 u	0.0031 u	0.003 u	0.0031 u	0.003 u	0.003 u
Benzo(a)pyrene		0.0049 u	0.0049 u	0.0049 u	0.0049 u	**0.055 j**	0.0049 u	0.0049 u	0.0049 u	0.0049 u	0.0049 u	0.0049 u	0.005 u	0.0049 u	0.0049 u	0.0049 u	0.005 u	0.0049 u	0.0049 u
Benzo(b)fluoranthene		0.0033 u	0.0033 u	0.0033 u	0.0033 u	**0.100**	0.0033 u	0.0033 u	0.0033 u	0.0033 u	0.0033 u	0.0033 u	0.0033 u	0.0033 u	0.0033 u	0.0033 u	0.0034 u	0.0033 u	0.0032 u
Benzo(g,h,i)perylene[2]		0.0034 u	0.0034 u	0.0034 u	0.0034 u	**0.100**	0.0034 u	0.0034 u	0.0034 u	0.0034 u	0.0034 u	0.0034 u	0.0034 u	0.0034 u	0.0034 u	0.0034 u	0.0035 u	0.0034 u	0.0034 u
Benzo(k)fluoranthene		0.0048 u	0.0048 u	0.0048 u	0.0048 u	**0.098**	0.0048 u	0.0048 u	0.0048 u	0.0048 u	0.0048 u	0.0048 u	0.0049 u	0.0048 u	0.0048 u	0.0048 u	0.0049 u	0.0048 u	0.0048 u
Chrysene		0.003 u	0.003 u	0.003 u	0.003 u	**0.110**	0.003 u	0.003 u	0.003 u	0.003 u	0.003 u	0.003 u	0.0031 u	0.0031 u	0.003 u	0.003 u	0.0031 u	0.003 u	0.003 u
Dibenz(a,h)anthracene		0.0046 u	0.0046 u	0.0046 u	0.0046 u	**0.110**	0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0047 u	0.0046 u	0.0046 u
Fluoranthene		0.0043 u	0.0043 u	0.0043 u	0.0043 u	**0.100**	0.0043 u	0.0043 u	0.0043 u	0.0043 u	0.0043 u	0.0043 u	0.0044 u	0.0043 u	0.0043 u	0.0043 u	0.0044 u	0.0043 u	0.0043 u
Fluorene		0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u	0.018 u
Indeno(1,2,3-cd)pyrene		0.014 u	0.014 u	0.014 u	0.014 u	**0.095**	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u	0.014 u
Methyl Acetate	330 u	1.600 u	1.600 u	1.600 u	1.600 u	1.600 u	1.600 u	1.600 u	1.600 u	1.600 u	1.600 u	1.600 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u
Cyclohexane	56 u	0.280 u	0.280 u	0.280 u	0.280 u	0.280 u	0.280 u	0.280 u	0.280 u	0.280 u	0.280 u	0.280 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u

results are in ug/kg or ppb
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)

Table A-4
Chemicals of Potential Concern (COPC)
SMA 4 Groundwater - ERP Coke

Chemical, µg/L	MW-78 11/19/2014	MW-78 5/20/2015	MW-78 8/12/2015	MW-78 11/11/2015	MW-78 2/17/2016	MW-80 2/19/2014	MW-80 5/13/2014	MW-80 11/18/2014	MW-80 5/19/2015	MW-81 2/19/2014	MW-81 5/13/2014	MW-81 11/18/2014	MW-81 5/19/2015	MW-89 2/19/2014	MW-89 6/15/2015	MW-90 2/19/2014	MW-90 5/14/2014	MW-90 11/19/2014
Vinylchloride	**0.340 j**	**0.290 j**	**0.240 j**	**0.260 j**	**0.490 j**	0.1000 u	0.1000 u	0.1000 u	0.1000 u	2 u	1 u	10 u	0.400 u	0.100 u	0.100 u	0.100 u	0.100 u	0.100 u
Acetone	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	**2.1000 jb**	**5.6000 jb**	1.9000 u	1.9000 u	**54 jb**	19 u	190 u	7.600 u	1.900 u	**17**	1.90 u	**7.40 jb**	1.900 u
Methylene chloride	0.320 u	0.320 u	0.320 u	0.320 u	0.320 u	0.3200 u	0.3200 u	0.3200 u	0.3200 u	**16 jb**	3.20 u	32 u	1.300 u	**0.410 jb**	0.320 u	0.320 u	0.320 u	0.320 u
Carbon disulfide	0.450 u	0.450 u	0.450 u	0.450 u	0.450 u	0.4500 u	0.4500 u	0.4500 u	0.4500 u	9 u	4.5 u	45 u	1.800 u	**0.790 j**	0.450 u	0.450 u	0.450 u	0.450 u
Methyl tert butyl ether	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u	5 u	2.5 u	25 u	1 u	0.25 u	0.25 u	0.25 u	0.25 u	0.25 u
trans-1,2-Dichloroethene	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u	3 u	1.5 u	15 u	0.600 u	0.150 u	0.150 u	0.150 u	0.150 u	0.150 u
cis-1,2-Dichloroethene	**0.460 j**	**0.440 j**	**0.590 j**	**0.430 j**	**0.420 j**	0.150 u	0.150 u	0.150 u	0.150 u	3 u	1.5 u	15 u	0.600 u	0.150 u	0.150 u	**0.680 j**	**2.200**	**1.600**
2-Butanone	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	2 u	40 u	20 u	200 u	8 u	2 u	2 u	2 u	2 u	2 u
Benzene	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	**460**	**240**	**3000**	**13**	**4**	**0.270 j**	0.160 u	0.160 u	0.160 u
1,2-Dichloroethane	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u	0.1300 u	0.1300 u	0.1300 u	0.1300 u	2.600 u	1.300 u	13 u	0.520 u	0.130 u	0.130 u	0.130 u	0.130 u	0.130 u
Trichloroethene	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	3.200 u	1.600 u	16 u	0.640 u	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u
4-Methyl-2-pentanone	0.980 u	0.980 u	0.980 u	0.980 u	0.980 u	0.9800 u	0.9800 u	0.9800 u	0.9800 u	20 u	9.800 u	98 u	3.900 u	**1.800 j**	0.980 u	0.980 u	0.980 u	0.980 u
Toluene	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	3.400 u	1.700 u	**280**	0.680 u	**21**	**0.610 j**	0.170 u	0.170 u	0.170 u
Chlorobenzene	**0.550 j**	**0.470 j**	**0.510 j**	**0.320 j**	**0.530 j**	0.1700 u	0.1700 u	0.1700 u	0.1700 u	**4.700 j**	**5.400 j**	17 u	**5.900**	0.170 u	0.170 u	0.170 u	**0.460 j**	**0.710 j**
Ethylbenzene	0.160 u	0.160 u	0.160 u	0.160 u	0.160 u	0.1600 u	0.1600 u	0.1600 u	0.1600 u	3.200 u	1.600 u	16 u	0.640 u	**4.700**	0.160 u	0.160 u	0.160 u	0.160 u
m,p-Xylenes	0.340 u	0.340 u	0.340 u	0.340 u	0.340 u	0.3400 u	0.3400 u	0.3400 u	0.3400 u	6.800 u	3.400 u	34 u	1.400 u	**23**	0.340 u	0.340 u	0.340 u	0.340 u
o-Xylene	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	3.800 u	1.900 u	19 u	0.760 u	**12**	0.190 u	0.190 u	0.190 u	0.190 u
Styrene	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u	0.1700 u	0.1700 u	0.1700 u	0.1700 u	3.400 u	1.700 u	17 u	0.680 u	0.170 u	0.170 u	0.170 u	0.170 u	0.170 u
Isopropylbenzene (Cumene)	0.190 u	0.190 u	0.190 u	0.190 u	0.190 u	0.1900 u	0.1900 u	0.1900 u	0.1900 u	**65**	**56**	**61 j**	**73**	**0.400 j**	0.190 u	0.190 u	0.190 u	0.190 u
1,4-Dioxane	1.600 u	57 u	57 u	57 u	57 u	**1.7000 j**	1.6000 u	1.6000 u	**1.9000 j**	1100 u	570 u	**1.80 j**	**1.80 j**	57 u	57 u	1.600 u	57 u	57 u
Cyclohexane, Methyl-	0.360 u	0.360 u		0.360 u	0.360 u	0.3600 u	0.3600 u	0.3600 u	0.3600 u	7.200 u	**4.300 j**	36 u	**11**	**16**	0.360 u	0.360 u	0.360 u	0.360 u
3/4-Methylphenol	**0.350 j**	0.240 u				**0.75 j**	**0.3400 j**	**0.6300 j**	**0.7000 j**	**0.290 j**	0.240 u	1.400 j	0.240 u			0.240 u	0.240 u	0.240 u
1,2,4-Trichlorobenzene	**0.640 j**	**0.210 u**	**0.210 u**	**0.210 u**	**0.210 u**	**0.2700 u**	**0.2700 u**	**0.2700 u**	**0.2100 u**	**4.200 u**	**0.270 u**	**21 u**	**0.270 u**	**0.210 u**	**0.210 u**	**0.210 u**	**0.210 u**	**0.270 u**
1,2-Dichlorobenzene	0.220 u	0.150 u	0.150 u	0.150 u	0.150 u	0.1500 u	0.2200 u	0.2200 u	0.1500 u	3 u	0.220 u	15 u	0.220 u	0.150 u	0.150 u	0.150 u	0.150 u	0.220 u
1,3-Dichlorobenzene	**0.210 j**	**0.290 u**				**0.2900 u**	**0.1300 u**	**0.2800 u**	**0.2800 u**	**0.280 u**	**0.290 u**	**0.290 u**	**0.520 u**			**0.280 u**	**0.130 u**	**0.280 u**
1,4-Dichlorobenzene	**0.510 j**	**0.470 j**				0.3000 u	0.3000 u	0.3000 u	0.1600 u	0.300 u	1.600 u	0.310 u	0.640 u			0.300 u	0.160 u	0.160 u
2,4-Dimethylphenol	0.550 u	0.550 u				0.5500 u	0.5500 u	0.5500 u	0.5500 u	0.550 u	0.550 u	0.550 u	0.550 u			0.550 u	0.550 u	0.550 u
2-Chlorophenol	1.900 u	1.900 u				1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u	1.900 u			1.900 u	1.900 u	1.900 u
2-Methylphenol	0.930 u	0.930 u				0.930 u	0.930 u	0.930 u	0.930 u	0.930 u	0.930 u	0.940 u	0.930 u			0.930 u	0.930 u	0.930 u
Acetophenone	0.230 u	0.230 u				0.23 u	0.23 u	0.23 u	0.23 u	**0.26 j**	0.23 u	**0.34 j**	0.23 u			0.230 u	0.230 u	0.230 u
Benzyl alcohol	0.220 u	0.220 u				0.22 u	0.22 u	0.22 u	0.22 u	0.22 u	0.22 u	0.22 u	0.22 u			0.220 u	0.220 u	0.220 u
Carbazole	0.410 u	0.410 u				0.41 u	0.41 u	0.41 u	0.41 u	0.41 u	0.41 u	0.41 u	0.41 u			0.410 u	0.410 u	0.410 u
Dibenzofuran	0.280 u	0.280 u				0.28 u	0.28 u	0.28 u	0.28 u	0.27 u	0.28 u	0.28 u	0.28 u			0.280 u	0.270 u	0.270 u
Dimethyl phthalate	0.200 u	0.200 u				0.20 u	0.20 u	0.20 u	0.20 u	0.20 u	0.20 u	0.20 u	0.20 u			0.200 u	0.200 u	0.200 u
Pentachlorophenol	19 u	19 u				19 u	19 u	19 u	19 u	19 u	19 u	19 u	19 u			19 u	19 u	19 u
Phenol	1.90 u	1.90 u				1.90 u	1.90 u	1.90 u	1.90 u	**4 j**	**2 j**	**29**	1.9 u			1.90 u	1.90 u	1.90 u
Pyrene	0.0078 u	0.0077 u				0.0076 u	0.0077 u	0.0076 u	**0.03 j**	**0.28**	**0.27**	**0.35**	**0.27**			0.0076 u	0.0077 u	0.0077 u
Naphthalene	0.0051 u	0.0051 u				0.005 u	0.0051 u	0.005 u	0.0051 u	**0.4**	**0.3**	**2.2**	**0.4**			0.005 u	0.0051 u	0.0051 u
2-Methylnaphthalene	0.0049 u	0.0049 u				0.0049 u	0.0049 u	0.0049 u	0.0049 u	**0.064 j**	**0.059 j**	**0.760**	**0.140**			0.0049 u	0.0049 u	0.0049 u
Acenaphthene	0.01 u	0.01 u				**0.4000**	**0.2400**	**0.1900**	**0.1100**	**10**	**12**	**14**	**12**			0.01 u	0.01 u	0.01 u
Acenaphthylene[2]	0.0096 u	0.0095 u				0.0094 u	0.0094 u	0.0094 u	0.0094 u	0.0094 u	**0.10**	0.0095 u	0.0095 u			0.0094 u	0.0095 u	0.0095 u
Anthracene	0.014 u	0.014 u				0.013 u	0.013 u	0.013 u	0.013 u	**0.56**	**0.53**	**0.64**	**0.37**			0.013 u	0.014 u	0.014 u
Benzo(a)anthracene	0.0031 u	0.0031 u				0.003 u	0.003 u	0.003 u	**0.017 j**	0.003 u	**0.01 j**	0.0031 u	**0.02 j**			0.003 u	0.0031 u	0.0031 u
Benzo(a)pyrene	0.0049 u	0.0049 u				0.0049 u	0.0049 u	0.0049 u	**0.017 j b**	0.0049 u	0.0049 u	0.0049 u	**0.014 j b**			0.0049 u	0.0049 u	0.0049 u
Benzo(b)fluoranthene	0.0033 u	0.0033 u				0.0032 u	0.0033 u	0.0033 u	**0.040 j b**	0.0033 u	**0.0083 j**	0.0033 u	**0.022 j b**			0.0033 u	0.0033 u	0.0033 u
Benzo(g,h,i)perylene[2]	0.0034 u	0.0034 u				**0.0048 j**	0.0034 u	**0.0056 j**	**0.024 j**	0.0034 u	**0.0037 j**	0.0034 u	**0.015 j**			**0.0052 j**	0.0034 u	0.0034 u
Benzo(k)fluoranthene	0.0049 u	0.0048 u				0.0048 u	0.0048 u	0.0048 u	**0.012 j b**	0.0048 u	0.0048 u	0.0048 u	0.0048 u			**0.0071 j**	0.0048 u	0.0048 u
Chrysene	0.0031 u	0.003 u				0.003 u	0.003 u	0.003 u	**0.029 j**	0.003 u	**0.0085 j**	0.003 u	**0.026 j**			0.003 u	0.003 u	0.003 u
Dibenz(a,h)anthracene	0.0046 u	0.0046 u				0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u	0.0046 u			**0.0069 j**	0.0046 u	0.0046 u
Fluoranthene	0.0044 u	0.0043 u				0.0043 u	0.0043 u	0.0043 u	**0.03 j**	**0.64**	**0.56**	**0.76**	**0.560**			0.0043 u	0.0043 u	0.0043 u
Fluorene	0.018 u	0.018 u				0.018 u	0.018 u	0.018 u	0.02 u	**5.60**	**6.20**	**6.60**	**4.5**			0.018 u	0.018 u	0.018 u
Indeno(1,2,3-cd)pyrene	0.014 u	0.014 u				0.014 u	0.014 u	0.014 u	**0.024 j**	0.014 u	0.014 u	0.014 u	**0.015 j**			0.014 u	0.014 u	0.014 u
Methyl Acetate	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	1.60 u	33 u	16 u	160 u	6.60 u	1.600 u	1.600 u	1.600 u	1.600 u	1.600 u
Cyclohexane	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	0.28 u	**8.60 j**	**10 j**	28 u	**12**	**27**	**0.330 j**	0.280 u	0.280 u	0.280 u

results are in ug/kg or ppb
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)

Table A-4
Chemicals of Potential Concern (COPC)
SMA 4 Groundwater - ERP Coke

Chemical, µg/L	MW-90 5/20/2015	MW-90 8/12/2015	MW-90 11/11/2015	MW-90 2/17/2016	PCS	MCLs/ Tapwater RSL
Vinylchloride	**0.320 j**	0.100 u	0.100 u	0.100 u	3.7	2
Acetone	1.900 u	1.900 u	1.900 u	1.900 u		
Methylene chloride	0.320 u	0.320 u	0.320 u	0.320 u	54.7	
Carbon disulfide	0.450 u	0.450 u	0.450 u	0.450 u		
Methyl tert butyl ether	0.25 u	0.25 u	0.25 u	0.25 u		
trans-1,2-Dichloroethene	0.150 u	**0.230 j**	0.150 u	0.150 u		
cis-1,2-Dichloroethene	**4.400**	**4.200**	**1.300**	**0.300 j**	20.2	70
2-Butanone	2 u	2 u	2 u	2 u		
Benzene	0.160 u	0.160 u	0.160 u	0.160 u	11	5
1,2-Dichloroethane	0.130 u	0.130 u	0.130 u	0.130 u	5.4	5
Trichloroethene	0.160 u	0.160 u	0.160 u	0.160 u	0.95	5
4-Methyl-2-pentanone	0.980 u	0.980 u	0.980 u	0.980 u		
Toluene	0.170 u	0.170 u	0.170 u	0.170 u	527	1000
Chlorobenzene	0.170 u	0.170 u	0.170 u	0.170 u	22	100
Ethylbenzene	0.160 u	0.160 u	0.160 u	0.160 u		
m,p-Xylenes	0.340 u	0.340 u	0.340 u	0.340 u		
o-Xylene	0.190 u	0.190 u	0.190 u	0.190 u		
Styrene	0.170 u	0.170 u	0.170 u	0.170 u		
Isopropylbenzene (Cumene)	0.190 u	0.190 u	0.190 u	0.190 u		
1,4-Dioxane	57 u	57 u	57 u	57 u	17	0.46
Cyclohexane, Methyl-	0.360 u	0.360 u	0.360 u	0.360 u		
3/4-Methylphenol	0.240 u					
1,2,4-Trichlorobenzene	**0.270 u**	**0.210 u**	**0.210 u**	**0.210 u**	1.2	70
1,2-Dichlorobenzene	0.150 u	0.150 u	0.150 u	0.150 u		
1,3-Dichlorobenzene	**0.290 u**					
1,4-Dichlorobenzene	0.310 u				15	75
2,4-Dimethylphenol	0.550 u					
2-Chlorophenol	1.900 u					
2-Methylphenol	0.930 u					
Acetophenone	0.230 u					
Benzyl alcohol	0.220 u					
Carbazole	0.410 u					
Dibenzofuran	0.280 u					
Dimethyl phthalate	0.200 u					
Pentachlorophenol	19 u				0.51	1
Phenol	1.90 u					
Pyrene	0.0077 u					
Naphthalene	0.0051 u				5.18	0.17
2-Methylnaphthalene	0.0049 u					
Acenaphthene	0.01 u					
Acenaphthylene[2]	0.0095 u					
Anthracene	0.013 u					
Benzo(a)anthracene	0.003 u				0.08	0.012
Benzo(a)pyrene	0.0049 u				0.005	0.2
Benzo(b)fluoranthene	0.0033 u				0.09	0.034
Benzo(g,h,i)perylene[2]	0.0034 u					
Benzo(k)fluoranthene	0.0048 u					
Chrysene	0.003 u					
Dibenz(a,h)anthracene	0.0046 u				0.003	0.0034
Fluoranthene	0.0043 u					
Fluorene	0.018 u					
Indeno(1,2,3-cd)pyrene	0.014 u				0.03	0.034
Methyl Acetate		1.60 u	1.60 u	1.60 u		
Cyclohexane	0.28 u	0.28 u	0.28 u	0.28 u		

results are in ug/kg or ppb
U = qualifier code for nondetected result
J = qualifier code for estimated result
BOLD font indicates a detected chemical concentration.
Red Highlighted and bolded font exceeds Preliminary Cleanup Standard (PCS)

SMA 4, Surface Soil ERP Coke, Birmingham, AL	UCL Statistics for Data Sets with Non-Detects PRO UCL v. 5.0.0 (2013)
User Selected Options	
Date/Time of Computation	4/27/2016 11:54:05 AM
From File	SMA 4, Surface Soil ProUCL input file.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Number of Detects	3	Number of Non-Detects	7
Number of Distinct Detects	3	Number of Distinct Non-Detects	7
Minimum Detect	0.061	Minimum Non-Detect	0.042
Maximum Detect	0.17	Maximum Non-Detect	0.53
Variance Detects	0.00304	Percent Non-Detects	70%
Mean Detects	0.12	SD Detects	0.0551
Median Detects	0.13	CV Detects	0.458
Skewness Detects	-0.765	Kurtosis Detects	N/A
Mean of Logged Detects	-2.203	SD of Logged Detects	0.532

Warning: Data set has only 3 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.512	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0719	Standard Error of Mean	0.0203
SD	0.0467	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.109	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.105	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.133	95% KM Chebyshev UCL	0.16
97.5% KM Chebyshev UCL	0.198	99% KM Chebyshev UCL	0.273

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	6.008	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.02	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	36.05	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	2.369	nu hat (KM)	47.38

		Adjusted Level of Significance (β)	0.0267
Approximate Chi Square Value (47.38, α)	32.58	Adjusted Chi Square Value (47.38, β)	30.46
95% Gamma Approximate KM-UCL (use when n>=50)	0.104	95% Gamma Adjusted KM-UCL (use when n<50)	0.112

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.287	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.512	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0553	Mean in Log Scale	-3.204
SD in Original Scale	0.0523	SD in Log Scale	0.769
95% t UCL (assumes normality of ROS data)	0.0856	95% Percentile Bootstrap UCL	0.0833
95% BCA Bootstrap UCL	0.0929	95% Bootstrap t UCL	0.151
95% H-UCL (Log ROS)	0.108		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.798	95% H-UCL (KM -Log)	0.105
KM SD (logged)	0.535	95% Critical H Value (KM-Log)	2.27
KM Standard Error of Mean (logged)	0.233		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.101	Mean in Log Scale	-2.785
SD in Original Scale	0.0983	SD in Log Scale	1.06
95% t UCL (Assumes normality)	0.157	95% H-Stat UCL	0.338

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.109	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benz(a)anthracene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.016	Mean	1.34
Maximum	6.6	Median	0.36
SD	2.071	Std. Error of Mean	0.655
Coefficient of Variation	1.546	Skewness	2.175

Normal GOF Test

Shapiro Wilk Test Statistic	0.687	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.318	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.28	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.54	95% Adjusted-CLT UCL (Chen-1995)	2.898
		95% Modified-t UCL (Johnson-1978)	2.615

Gamma GOF Test

A-D Test Statistic	0.307	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.775	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.19	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.522	k star (bias corrected MLE)	0.432
Theta hat (MLE)	2.565	Theta star (bias corrected MLE)	3.099
nu hat (MLE)	10.45	nu star (bias corrected)	8.646
MLE Mean (bias corrected)	1.34	MLE Sd (bias corrected)	2.037
		Approximate Chi Square Value (0.05)	3.114
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2.566

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	3.719	95% Adjusted Gamma UCL (use when n<50)	4.513

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.122	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.135	Mean of logged Data	-0.916
Maximum of Logged Data	1.887	SD of logged Data	1.846

Assuming Lognormal Distribution

95% H-UCL	48.3	90% Chebyshev (MVUE) UCL	4.433
95% Chebyshev (MVUE) UCL	5.73	97.5% Chebyshev (MVUE) UCL	7.529
99% Chebyshev (MVUE) UCL	11.06		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.417	95% Jackknife UCL	2.54
95% Standard Bootstrap UCL	2.374	95% Bootstrap-t UCL	4.141
95% Hall's Bootstrap UCL	5.614	95% Percentile Bootstrap UCL	2.433
95% BCA Bootstrap UCL	2.956		

90% Chebyshev(Mean, Sd) UCL	3.305	95% Chebyshev(Mean, Sd) UCL	4.195
97.5% Chebyshev(Mean, Sd) UCL	5.43	99% Chebyshev(Mean, Sd) UCL	7.856

Suggested UCL to Use

95% Adjusted Gamma UCL 4.513

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Benzo(a)pyrene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.018	Mean	1.39
Maximum	7.7	Median	0.245
SD	2.444	Std. Error of Mean	0.773
Coefficient of Variation	1.758	Skewness	2.35

Normal GOF Test

Shapiro Wilk Test Statistic	0.629	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.324	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.28	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.807	95% Adjusted-CLT UCL (Chen-1995)	3.276
		95% Modified-t UCL (Johnson-1978)	2.903

Gamma GOF Test

A-D Test Statistic	0.492	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.783	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.236	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.465	k star (bias corrected MLE)	0.392
Theta hat (MLE)	2.989	Theta star (bias corrected MLE)	3.544
nu hat (MLE)	9.303	nu star (bias corrected)	7.846
MLE Mean (bias corrected)	1.39	MLE Sd (bias corrected)	2.22
		Approximate Chi Square Value (0.05)	2.646
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2.151

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	4.122	95% Adjusted Gamma UCL (use when n<50)	5.071

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk Lognormal GOF Test**	

5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.147	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.017	Mean of logged Data	-1.051
Maximum of Logged Data	2.041	SD of logged Data	1.864

Assuming Lognormal Distribution

95% H-UCL	46.17	90% Chebyshev (MVUE) UCL	3.987
95% Chebyshev (MVUE) UCL	5.157	97.5% Chebyshev (MVUE) UCL	6.78
99% Chebyshev (MVUE) UCL	9.968		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.662	95% Jackknife UCL	2.807
95% Standard Bootstrap UCL	2.606	95% Bootstrap-t UCL	7.691
95% Hall's Bootstrap UCL	8.208	95% Percentile Bootstrap UCL	2.719
95% BCA Bootstrap UCL	3.243		
90% Chebyshev(Mean, Sd) UCL	3.709	95% Chebyshev(Mean, Sd) UCL	4.76
97.5% Chebyshev(Mean, Sd) UCL	6.218	99% Chebyshev(Mean, Sd) UCL	9.081

Suggested UCL to Use

95% Adjusted Gamma UCL	5.071

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.028	Mean	2.337
Maximum	13	Median	0.485
SD	4.084	Std. Error of Mean	1.292
Coefficient of Variation	1.748	Skewness	2.402

Normal GOF Test

Shapiro Wilk Test Statistic	0.632	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.338	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.28	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4.704	95% Adjusted-CLT UCL (Chen-1995)	5.509

95% Modified-t UCL (Johnson-1978)	4.868

Gamma GOF Test

A-D Test Statistic	0.452	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.783	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.469	k star (bias corrected MLE)	0.395
Theta hat (MLE)	4.985	Theta star (bias corrected MLE)	5.919
nu hat (MLE)	9.375	nu star (bias corrected)	7.896
MLE Mean (bias corrected)	2.337	MLE Sd (bias corrected)	3.719
		Approximate Chi Square Value (0.05)	2.675
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2.176

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	6.898	95% Adjusted Gamma UCL (use when n<50)	8.478

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.984	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.137	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-3.576	Mean of logged Data	-0.52
Maximum of Logged Data	2.565	SD of logged Data	1.867

Assuming Lognormal Distribution

95% H-UCL	79.95	90% Chebyshev (MVUE) UCL	6.823
95% Chebyshev (MVUE) UCL	8.825	97.5% Chebyshev (MVUE) UCL	11.6
99% Chebyshev (MVUE) UCL	17.06		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4.461	95% Jackknife UCL	4.704
95% Standard Bootstrap UCL	4.345	95% Bootstrap-t UCL	11.44
95% Hall's Bootstrap UCL	12.11	95% Percentile Bootstrap UCL	4.445
95% BCA Bootstrap UCL	5.671		
90% Chebyshev(Mean, Sd) UCL	6.211	95% Chebyshev(Mean, Sd) UCL	7.967
97.5% Chebyshev(Mean, Sd) UCL	10.4	99% Chebyshev(Mean, Sd) UCL	15.19

Suggested UCL to Use

95% Adjusted Gamma UCL	8.478

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.

For additional insight the user may want to consult a statistician.

Chrysene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.021	Mean	2.116
Maximum	9.4	Median	0.665
SD	3.1	Std. Error of Mean	0.98
Coefficient of Variation	1.465	Skewness	1.772

Normal GOF Test

Shapiro Wilk Test Statistic	0.718	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.363	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.28	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.913	95% Adjusted-CLT UCL (Chen-1995)	4.315
		95% Modified-t UCL (Johnson-1978)	4.005

Gamma GOF Test

A-D Test Statistic	0.394	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.776	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.244	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.518	k star (bias corrected MLE)	0.429
Theta hat (MLE)	4.083	Theta star (bias corrected MLE)	4.927
nu hat (MLE)	10.37	nu star (bias corrected)	8.59
MLE Mean (bias corrected)	2.116	MLE Sd (bias corrected)	3.229
		Approximate Chi Square Value (0.05)	3.081
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2.536

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	5.899	95% Adjusted Gamma UCL (use when n<50)	7.166

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.145	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-3.863	Mean of logged Data	-0.469
Maximum of Logged Data	2.241	SD of logged Data	1.871

Assuming Lognormal Distribution

95% H-UCL	85.88	90% Chebyshev (MVUE) UCL	7.228
95% Chebyshev (MVUE) UCL	9.35	97.5% Chebyshev (MVUE) UCL	12.3
99% Chebyshev (MVUE) UCL	18.08		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3.728	95% Jackknife UCL	3.913
95% Standard Bootstrap UCL	3.659	95% Bootstrap-t UCL	5.763
95% Hall's Bootstrap UCL	3.851	95% Percentile Bootstrap UCL	3.789
95% BCA Bootstrap UCL	4.045		
90% Chebyshev(Mean, Sd) UCL	5.057	95% Chebyshev(Mean, Sd) UCL	6.389
97.5% Chebyshev(Mean, Sd) UCL	8.238	99% Chebyshev(Mean, Sd) UCL	11.87

Suggested UCL to Use

95% Adjusted Gamma UCL 7.166

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Number of Detects	9	Number of Non-Detects	1
Number of Distinct Detects	9	Number of Distinct Non-Detects	1
Minimum Detect	0.013	Minimum Non-Detect	0.016
Maximum Detect	2.1	Maximum Non-Detect	0.016
Variance Detects	0.479	Percent Non-Detects	10%
Mean Detects	0.427	SD Detects	0.692
Median Detects	0.096	CV Detects	1.621
Skewness Detects	2.17	Kurtosis Detects	4.761
Mean of Logged Detects	-2.057	SD of Logged Detects	1.705

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.671	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.338	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.295	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.386	Standard Error of Mean	0.212
SD	0.631	95% KM (BCA) UCL	0.747
95% KM (t) UCL	0.774	95% KM (Percentile Bootstrap) UCL	0.75
95% KM (z) UCL	0.734	95% KM Bootstrap t UCL	1.708
90% KM Chebyshev UCL	1.021	95% KM Chebyshev UCL	1.309
97.5% KM Chebyshev UCL	1.708	99% KM Chebyshev UCL	2.493

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.509	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.769	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.273	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.523	k star (bias corrected MLE)	0.423
Theta hat (MLE)	0.816	Theta star (bias corrected MLE)	1.01
nu hat (MLE)	9.414	nu star (bias corrected)	7.609
MLE Mean (bias corrected)	0.427	MLE Sd (bias corrected)	0.657

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.373	nu hat (KM)	7.46
Approximate Chi Square Value (7.46, α)	2.426	Adjusted Chi Square Value (7.46, β)	1.958
95% Gamma Approximate KM-UCL (use when n>=50)	1.186	95% Gamma Adjusted KM-UCL (use when n<50)	1.469

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.385
Maximum	2.1	Median	0.0845
SD	0.666	CV	1.728
k hat (MLE)	0.472	k star (bias corrected MLE)	0.397
Theta hat (MLE)	0.816	Theta star (bias corrected MLE)	0.971
nu hat (MLE)	9.438	nu star (bias corrected)	7.94
MLE Mean (bias corrected)	0.385	MLE Sd (bias corrected)	0.612
		Adjusted Level of Significance (β)	0.0267
Approximate Chi Square Value (7.94, α)	2.7	Adjusted Chi Square Value (7.94, β)	2.199
95% Gamma Approximate UCL (use when n>=50)	1.133	95% Gamma Adjusted UCL (use when n<50)	1.391

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.181	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.295	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.385	Mean in Log Scale	-2.35
SD in Original Scale	0.666	SD in Log Scale	1.854
95% t UCL (assumes normality of ROS data)	0.771	95% Percentile Bootstrap UCL	0.726
95% BCA Bootstrap UCL	0.873	95% Bootstrap t UCL	1.723
95% H-UCL (Log ROS)	12.03		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.286	95% H-UCL (KM -Log)	5.365
KM SD (logged)	1.672	95% Critical H Value (KM-Log)	4.609
KM Standard Error of Mean (logged)	0.561		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.385	Mean in Log Scale	-2.334
SD in Original Scale	0.666	SD in Log Scale	1.83
95% t UCL (Assumes normality)	0.771	95% H-Stat UCL	10.85

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1.309	95% GROS Adjusted Gamma UCL	1.391
95% Adjusted Gamma KM-UCL	1.469		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.019	Mean	1.147
Maximum	6.3	Median	0.205
SD	2.014	Std. Error of Mean	0.637
Coefficient of Variation	1.756	Skewness	2.301

Normal GOF Test

Shapiro Wilk Test Statistic	0.632	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.332	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.28	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	2.314	95% Adjusted-CLT UCL (Chen-1995)	2.689
		95% Modified-t UCL (Johnson-1978)	2.391

Gamma GOF Test

A-D Test Statistic	0.527	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.784	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.242	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.463	k star (bias corrected MLE)	0.391
Theta hat (MLE)	2.475	Theta star (bias corrected MLE)	2.933
nu hat (MLE)	9.266	nu star (bias corrected)	7.819
MLE Mean (bias corrected)	1.147	MLE Sd (bias corrected)	1.834

		Approximate Chi Square Value (0.05)	2.631
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2.138

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	3.408	95% Adjusted Gamma UCL (use when n<50)	4.195

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.157	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-3.963	Mean of logged Data	-1.251
Maximum of Logged Data	1.841	SD of logged Data	1.837

Assuming Lognormal Distribution

95% H-UCL	33.15	90% Chebyshev (MVUE) UCL	3.128
95% Chebyshev (MVUE) UCL	4.042	97.5% Chebyshev (MVUE) UCL	5.309
99% Chebyshev (MVUE) UCL	7.8		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.194	95% Jackknife UCL	2.314
95% Standard Bootstrap UCL	2.136	95% Bootstrap-t UCL	6.658
95% Hall's Bootstrap UCL	6.679	95% Percentile Bootstrap UCL	2.289
95% BCA Bootstrap UCL	2.839		
90% Chebyshev(Mean, Sd) UCL	3.057	95% Chebyshev(Mean, Sd) UCL	3.922
97.5% Chebyshev(Mean, Sd) UCL	5.123	99% Chebyshev(Mean, Sd) UCL	7.483

Suggested UCL to Use

95% Adjusted Gamma UCL	4.195

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Naphthalene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.017	Mean	1.281
Maximum	5.8	Median	0.51
SD	1.878	Std. Error of Mean	0.594
Coefficient of Variation	1.467	Skewness	1.937

Normal GOF Test

Shapiro Wilk Test Statistic	0.723	**Shapiro Wilk GOF Test**	

5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.287	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.28	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.37	95% Adjusted-CLT UCL (Chen-1995)	2.647
		95% Modified-t UCL (Johnson-1978)	2.43

Gamma GOF Test

A-D Test Statistic	0.227	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.777	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.142	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	0.281	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.502	k star (bias corrected MLE)	0.418
Theta hat (MLE)	2.55	Theta star (bias corrected MLE)	3.062
nu hat (MLE)	10.04	nu star (bias corrected)	8.364
MLE Mean (bias corrected)	1.281	MLE Sd (bias corrected)	1.98
		Approximate Chi Square Value (0.05)	2.948
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2.418

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	3.634	95% Adjusted Gamma UCL (use when n<50)	4.43

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.128	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.075	Mean of logged Data	-1.017
Maximum of Logged Data	1.758	SD of logged Data	1.981

Assuming Lognormal Distribution

95% H-UCL	88.04	90% Chebyshev (MVUE) UCL	5.021
95% Chebyshev (MVUE) UCL	6.52	97.5% Chebyshev (MVUE) UCL	8.601
99% Chebyshev (MVUE) UCL	12.69		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.258	95% Jackknife UCL	2.37
95% Standard Bootstrap UCL	2.229	95% Bootstrap-t UCL	4.55
95% Hall's Bootstrap UCL	6.678	95% Percentile Bootstrap UCL	2.32
95% BCA Bootstrap UCL	2.541		
90% Chebyshev(Mean, Sd) UCL	3.063	95% Chebyshev(Mean, Sd) UCL	3.87

97.5% Chebyshev(Mean, Sd) UCL	4.99	99% Chebyshev(Mean, Sd) UCL	7.191

Suggested UCL to Use

95% Adjusted Gamma UCL 4.43

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Aluminum

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	7000	Mean	15620
Maximum	49000	Median	10450
SD	12742	Std. Error of Mean	4030
Coefficient of Variation	0.816	Skewness	2.407

Normal GOF Test

Shapiro Wilk Test Statistic	0.672	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.288	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.28	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	23007	95% Adjusted-CLT UCL (Chen-1995)	25525
		95% Modified-t UCL (Johnson-1978)	23518

Gamma GOF Test

A-D Test Statistic	0.87	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.733	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.269	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.742	k star (bias corrected MLE)	1.986
Theta hat (MLE)	5696	Theta star (bias corrected MLE)	7864
nu hat (MLE)	54.84	nu star (bias corrected)	39.72
MLE Mean (bias corrected)	15620	MLE Sd (bias corrected)	11083
		Approximate Chi Square Value (0.05)	26.28
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	24.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	23607	95% Adjusted Gamma UCL (use when n<50)	25431

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.858	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level

Lilliefors Test Statistic	0.205	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.854	Mean of logged Data	9.463
Maximum of Logged Data	10.8	SD of logged Data	0.591

Assuming Lognormal Distribution

95% H-UCL	24365	90% Chebyshev (MVUE) UCL	23654
95% Chebyshev (MVUE) UCL	27560	97.5% Chebyshev (MVUE) UCL	32982
99% Chebyshev (MVUE) UCL	43631		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	22248	95% Jackknife UCL	23007
95% Standard Bootstrap UCL	22024	95% Bootstrap-t UCL	42222
95% Hall's Bootstrap UCL	49395	95% Percentile Bootstrap UCL	22830
95% BCA Bootstrap UCL	26240		
90% Chebyshev(Mean, Sd) UCL	27709	95% Chebyshev(Mean, Sd) UCL	33184
97.5% Chebyshev(Mean, Sd) UCL	40784	99% Chebyshev(Mean, Sd) UCL	55713

Suggested UCL to Use

95% Adjusted Gamma UCL	25431

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Arsenic

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	6.7	Mean	15.95
Maximum	26	Median	14
SD	6.801	Std. Error of Mean	2.151
Coefficient of Variation	0.426	Skewness	0.346

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.168	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.28	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	19.89	95% Adjusted-CLT UCL (Chen-1995)	19.74
		95% Modified-t UCL (Johnson-1978)	19.93

Gamma GOF Test

A-D Test Statistic	0.252	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.159	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.85	k star (bias corrected MLE)	4.161
Theta hat (MLE)	2.727	Theta star (bias corrected MLE)	3.833
nu hat (MLE)	117	nu star (bias corrected)	83.23
MLE Mean (bias corrected)	15.95	MLE Sd (bias corrected)	7.819
		Approximate Chi Square Value (0.05)	63.2
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	60.18

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	21	95% Adjusted Gamma UCL (use when n<50)	22.06

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.142	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.902	Mean of logged Data	2.682
Maximum of Logged Data	3.258	SD of logged Data	0.453

Assuming Lognormal Distribution

95% H-UCL	22.4	90% Chebyshev (MVUE) UCL	22.98
95% Chebyshev (MVUE) UCL	26.14	97.5% Chebyshev (MVUE) UCL	30.53
99% Chebyshev (MVUE) UCL	39.14		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	19.49	95% Jackknife UCL	19.89
95% Standard Bootstrap UCL	19.31	95% Bootstrap-t UCL	20.39
95% Hall's Bootstrap UCL	19.25	95% Percentile Bootstrap UCL	19.4
95% BCA Bootstrap UCL	19.5		
90% Chebyshev(Mean, Sd) UCL	22.4	95% Chebyshev(Mean, Sd) UCL	25.32
97.5% Chebyshev(Mean, Sd) UCL	29.38	99% Chebyshev(Mean, Sd) UCL	37.35

Suggested UCL to Use

95% Student's-t UCL	19.89

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Chromium

General Statistics

Total Number of Observations	10	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	22	Mean	42.2
Maximum	68	Median	39.5
SD	14.05	Std. Error of Mean	4.442
Coefficient of Variation	0.333	Skewness	0.726

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.156	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.28	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	50.34	95% Adjusted-CLT UCL (Chen-1995)	50.6
		95% Modified-t UCL (Johnson-1978)	50.51

Gamma GOF Test

A-D Test Statistic	0.293	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.156	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	10.36	k star (bias corrected MLE)	7.318
Theta hat (MLE)	4.074	Theta star (bias corrected MLE)	5.767
nu hat (MLE)	207.2	nu star (bias corrected)	146.4
MLE Mean (bias corrected)	42.2	MLE Sd (bias corrected)	15.6
		Approximate Chi Square Value (0.05)	119.4
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	115.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	51.73	95% Adjusted Gamma UCL (use when n<50)	53.63

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.176	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.091	Mean of logged Data	3.693
Maximum of Logged Data	4.22	SD of logged Data	0.331

Assuming Lognormal Distribution

95% H-UCL	52.99	90% Chebyshev (MVUE) UCL	55.58
95% Chebyshev (MVUE) UCL	61.64	97.5% Chebyshev (MVUE) UCL	70.05
99% Chebyshev (MVUE) UCL	86.56		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	49.51	95% Jackknife UCL	50.34
95% Standard Bootstrap UCL	49.11	95% Bootstrap-t UCL	53.22
95% Hall's Bootstrap UCL	57.04	95% Percentile Bootstrap UCL	49.3
95% BCA Bootstrap UCL	49.5		
90% Chebyshev(Mean, Sd) UCL	55.53	95% Chebyshev(Mean, Sd) UCL	61.56
97.5% Chebyshev(Mean, Sd) UCL	69.94	99% Chebyshev(Mean, Sd) UCL	86.39

Suggested UCL to Use

95% Student's-t UCL 50.34

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Cobalt

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	4.5	Mean	10.1
Maximum	18	Median	9.15
SD	4.834	Std. Error of Mean	1.529
Coefficient of Variation	0.479	Skewness	0.457

Normal GOF Test

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.28	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	12.9	95% Adjusted-CLT UCL (Chen-1995)	12.85
		95% Modified-t UCL (Johnson-1978)	12.94

Gamma GOF Test

A-D Test Statistic	0.335	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.165	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	0.268	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.719	k star (bias corrected MLE)	3.37
Theta hat (MLE)	2.14	Theta star (bias corrected MLE)	2.997
nu hat (MLE)	94.39	nu star (bias corrected)	67.4
MLE Mean (bias corrected)	10.1	MLE Sd (bias corrected)	5.502
		Approximate Chi Square Value (0.05)	49.51
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	46.85

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	13.75	95% Adjusted Gamma UCL (use when n<50)	14.53

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.156	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.504	Mean of logged Data	2.203
Maximum of Logged Data	2.89	SD of logged Data	0.503

Assuming Lognormal Distribution

95% H-UCL	14.92	90% Chebyshev (MVUE) UCL	15.06
95% Chebyshev (MVUE) UCL	17.29	97.5% Chebyshev (MVUE) UCL	20.39
99% Chebyshev (MVUE) UCL	26.47		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	12.61	95% Jackknife UCL	12.9
95% Standard Bootstrap UCL	12.48	95% Bootstrap-t UCL	13.43
95% Hall's Bootstrap UCL	12.71	95% Percentile Bootstrap UCL	12.53
95% BCA Bootstrap UCL	12.68		
90% Chebyshev(Mean, Sd) UCL	14.69	95% Chebyshev(Mean, Sd) UCL	16.76
97.5% Chebyshev(Mean, Sd) UCL	19.65	99% Chebyshev(Mean, Sd) UCL	25.31

Suggested UCL to Use

95% Student's-t UCL	12.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Manganese

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	320	Mean	1092
Maximum	2500	Median	935
SD	577.3	Std. Error of Mean	182.5

Coefficient of Variation	0.529	Skewness	1.694

Normal GOF Test

Shapiro Wilk Test Statistic	0.818	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.28	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1427	95% Adjusted-CLT UCL (Chen-1995)	1497
		95% Modified-t UCL (Johnson-1978)	1443

Gamma GOF Test

A-D Test Statistic	0.625	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.23	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.268	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.467	k star (bias corrected MLE)	3.194
Theta hat (MLE)	244.4	Theta star (bias corrected MLE)	341.9
nu hat (MLE)	89.35	nu star (bias corrected)	63.88
MLE Mean (bias corrected)	1092	MLE Sd (bias corrected)	611
		Approximate Chi Square Value (0.05)	46.49
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	43.92

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1500	95% Adjusted Gamma UCL (use when n<50)	1588

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.262	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.768	Mean of logged Data	6.88
Maximum of Logged Data	7.824	SD of logged Data	0.519

Assuming Lognormal Distribution

95% H-UCL	1641	90% Chebyshev (MVUE) UCL	1646
95% Chebyshev (MVUE) UCL	1895	97.5% Chebyshev (MVUE) UCL	2241
99% Chebyshev (MVUE) UCL	2920		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1392	95% Jackknife UCL	1427

95% Standard Bootstrap UCL	1376	95% Bootstrap-t UCL	1737
95% Hall's Bootstrap UCL	3262	95% Percentile Bootstrap UCL	1402
95% BCA Bootstrap UCL	1455		
90% Chebyshev(Mean, Sd) UCL	1640	95% Chebyshev(Mean, Sd) UCL	1888
97.5% Chebyshev(Mean, Sd) UCL	2232	99% Chebyshev(Mean, Sd) UCL	2908

Suggested UCL to Use

95% Student's-t UCL 1427

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Vanadium

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	22	Mean	36.9
Maximum	69	Median	33.5
SD	13.91	Std. Error of Mean	4.398
Coefficient of Variation	0.377	Skewness	1.4

Normal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.19	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.28	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	44.96	95% Adjusted-CLT UCL (Chen-1995)	46.22
		95% Modified-t UCL (Johnson-1978)	45.29

Gamma GOF Test

A-D Test Statistic	0.295	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.726	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.187	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	9.026	k star (bias corrected MLE)	6.385
Theta hat (MLE)	4.088	Theta star (bias corrected MLE)	5.779
nu hat (MLE)	180.5	nu star (bias corrected)	127.7
MLE Mean (bias corrected)	36.9	MLE Sd (bias corrected)	14.6
		Approximate Chi Square Value (0.05)	102.6
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	98.69

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	45.93	95% Adjusted Gamma UCL (use when n<50)	47.75

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.091	Mean of logged Data	3.552
Maximum of Logged Data	4.234	SD of logged Data	0.346

Assuming Lognormal Distribution

95% H-UCL	46.77	90% Chebyshev (MVUE) UCL	48.98
95% Chebyshev (MVUE) UCL	54.5	97.5% Chebyshev (MVUE) UCL	62.15
99% Chebyshev (MVUE) UCL	77.2		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	44.13	95% Jackknife UCL	44.96
95% Standard Bootstrap UCL	43.78	95% Bootstrap-t UCL	48.87
95% Hall's Bootstrap UCL	73.36	95% Percentile Bootstrap UCL	44.1
95% BCA Bootstrap UCL	45.7		
90% Chebyshev(Mean, Sd) UCL	50.09	95% Chebyshev(Mean, Sd) UCL	56.07
97.5% Chebyshev(Mean, Sd) UCL	64.37	99% Chebyshev(Mean, Sd) UCL	80.66

Suggested UCL to Use

95% Student's-t UCL	44.96

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

SMA 4, Subsurface Soil 2-15 ft ERP Coke, Birmingham, AL	UCL Statistics for Data Sets with Non-Detects PRO UCL v. 5.0.0 (2013)
User Selected Options	
Date/Time of Computation	4/10/2016 12:39:15 AM
From File	SMA 4, Soil ProUCL input file.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1,2-Trichloroethane

General Statistics

Total Number of Observations	177	Number of Distinct Observations	72
Number of Detects	1	Number of Non-Detects	176
Number of Distinct Detects	1	Number of Distinct Non-Detects	71

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,1,2-Trichloroethane was not processed!

1,2-Dichloroethane

General Statistics

Total Number of Observations	177	Number of Distinct Observations	69
Number of Detects	2	Number of Non-Detects	175
Number of Distinct Detects	2	Number of Distinct Non-Detects	67
Minimum Detect	0.0052	Minimum Non-Detect	0.0014
Maximum Detect	1.1	Maximum Non-Detect	130
Variance Detects	0.599	Percent Non-Detects	98.87%
Mean Detects	0.553	SD Detects	0.774
Median Detects	0.553	CV Detects	1.401
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-2.582	SD of Logged Detects	3.786

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.00838	Standard Error of Mean	0.00974
SD	0.0868	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.0245	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.0244	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.0376	95% KM Chebyshev UCL	0.0508
97.5% KM Chebyshev UCL	0.0692	99% KM Chebyshev UCL	0.105

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.34	k star (bias corrected MLE)	N/A
Theta hat (MLE)	1.626	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	1.359	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0093	nu hat (KM)	3.293
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (3.29, α)	0.464	Adjusted Chi Square Value (3.29, β)	0.456
95% Gamma Approximate KM-UCL (use when n>=50)	0.0594	95% Gamma Adjusted KM-UCL (use when n<50)	0.0604

Gamma (KM) may not be used when k hat (KM) is < 0.1

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00624	Mean in Log Scale	-25.82
SD in Original Scale	0.0827	SD in Log Scale	6.11
95% t UCL (assumes normality of ROS data)	0.0165	95% Percentile Bootstrap UCL	0.0187
95% BCA Bootstrap UCL	0.0311	95% Bootstrap t UCL	4539
95% H-UCL (Log ROS)	0.0392		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	1.188	Mean in Log Scale	-3.412
SD in Original Scale	6.698	SD in Log Scale	2.702
95% t UCL (Assumes normality)	2.021	95% H-Stat UCL	2.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 0.0692

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,2-Dichloropropane

General Statistics

Total Number of Observations	177	Number of Distinct Observations	74
Number of Detects	1	Number of Non-Detects	176
Number of Distinct Detects	1	Number of Distinct Non-Detects	74

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,2-Dichloropropane was not processed!

Benzene

General Statistics

Total Number of Observations	176	Number of Distinct Observations	128
Number of Detects	146	Number of Non-Detects	30
Number of Distinct Detects	115	Number of Distinct Non-Detects	18
Minimum Detect	9.3000E-4	Minimum Non-Detect	9.3000E-4
Maximum Detect	1400	Maximum Non-Detect	0.35

Variance Detects	19416	Percent Non-Detects	17.05%
Mean Detects	32.88	SD Detects	139.3
Median Detects	1.3	CV Detects	4.237
Skewness Detects	7.789	Kurtosis Detects	69.32
Mean of Logged Detects	-0.237	SD of Logged Detects	3.45

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.268	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.407	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0733	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	27.28	Standard Error of Mean	9.612
SD	127.1	95% KM (BCA) UCL	44.7
95% KM (t) UCL	43.18	95% KM (Percentile Bootstrap) UCL	44.93
95% KM (z) UCL	43.09	95% KM Bootstrap t UCL	66.19
90% KM Chebyshev UCL	56.12	95% KM Chebyshev UCL	69.18
97.5% KM Chebyshev UCL	87.31	99% KM Chebyshev UCL	122.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.618	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.921	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.165	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.0863	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.198	k star (bias corrected MLE)	0.198
Theta hat (MLE)	166.4	Theta star (bias corrected MLE)	165.9
nu hat (MLE)	57.72	nu star (bias corrected)	57.87
MLE Mean (bias corrected)	32.88	MLE Sd (bias corrected)	73.87

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0461	nu hat (KM)	16.22
Approximate Chi Square Value (16.22, α)	8.12	Adjusted Chi Square Value (16.22, β)	8.072
95% Gamma Approximate KM-UCL (use when n>=50)	54.51	95% Gamma Adjusted KM-UCL (use when n<50)	54.83

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	9.3000E-4	Mean	27.28
Maximum	1400	Median	0.53
SD	127.4	CV	4.671
k hat (MLE)	0.175	k star (bias corrected MLE)	0.176
Theta hat (MLE)	155.7	Theta star (bias corrected MLE)	155
nu hat (MLE)	61.66	nu star (bias corrected)	61.94
MLE Mean (bias corrected)	27.28	MLE Sd (bias corrected)	65.03
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (61.94, α)	44.84	Adjusted Chi Square Value (61.94, β)	44.72
95% Gamma Approximate UCL (use when n>=50)	37.69	95% Gamma Adjusted UCL (use when n<50)	37.79

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.0775	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0733	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	27.28	Mean in Log Scale	-1.297
SD in Original Scale	127.4	SD in Log Scale	3.993
95% t UCL (assumes normality of ROS data)	43.17	95% Percentile Bootstrap UCL	44.98
95% BCA Bootstrap UCL	53.21	95% Bootstrap t UCL	63.49
95% H-UCL (Log ROS)	4433		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	27.29	Mean in Log Scale	-1.054
SD in Original Scale	127.4	SD in Log Scale	3.753
95% t UCL (Assumes normality)	43.17	95% H-Stat UCL	1839

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 87.31

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Carbon tetrachloride

General Statistics

Total Number of Observations	177	Number of Distinct Observations	78
Number of Detects	2	Number of Non-Detects	175
Number of Distinct Detects	2	Number of Distinct Non-Detects	78
Minimum Detect	0.0019	Minimum Non-Detect	0.001
Maximum Detect	0.35	Maximum Non-Detect	89
Variance Detects	0.0606	Percent Non-Detects	98.87%
Mean Detects	0.176	SD Detects	0.246
Median Detects	0.176	CV Detects	1.399
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-3.658	SD of Logged Detects	3.688

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0033	Standard Error of Mean	0.00322
SD	0.0281	95% KM (BCA) UCL	N/A

95% KM (t) UCL	0.00861	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.00859	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.0129	95% KM Chebyshev UCL	0.0173
97.5% KM Chebyshev UCL	0.0234	99% KM Chebyshev UCL	0.0353

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.35	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.503	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	1.401	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0137	nu hat (KM)	4.867
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (4.87, α)	1.091	Adjusted Chi Square Value (4.87, β)	1.077
95% Gamma Approximate KM-UCL (use when n>=50)	0.0147	95% Gamma Adjusted KM-UCL (use when n<50)	0.0149

Gamma (KM) may not be used when k hat (KM) is < 0.1

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00199	Mean in Log Scale	-26.1
SD in Original Scale	0.0263	SD in Log Scale	5.614
95% t UCL (assumes normality of ROS data)	0.00526	95% Percentile Bootstrap UCL	0.00594
95% BCA Bootstrap UCL	0.00794	95% Bootstrap t UCL	524.4
95% H-UCL (Log ROS)	8.8939E-4		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.825	Mean in Log Scale	-3.703
SD in Original Scale	4.565	SD in Log Scale	2.748
95% t UCL (Assumes normality)	1.393	95% H-Stat UCL	2.515

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 0.0234

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chlorobenzene

General Statistics

Total Number of Observations	177	Number of Distinct Observations	126
Number of Detects	96	Number of Non-Detects	81
Number of Distinct Detects	86	Number of Distinct Non-Detects	48
Minimum Detect	0.0014	Minimum Non-Detect	7.9000E-4
Maximum Detect	6100	Maximum Non-Detect	4.2

Variance Detects	389209	Percent Non-Detects	45.76%
Mean Detects	98.64	SD Detects	623.9
Median Detects	3.55	CV Detects	6.325
Skewness Detects	9.57	Kurtosis Detects	92.92
Mean of Logged Detects	0.715	SD of Logged Detects	3.546

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.158	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.437	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0904	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	53.5	Standard Error of Mean	34.73
SD	459.7	95% KM (BCA) UCL	121.8
95% KM (t) UCL	110.9	95% KM (Percentile Bootstrap) UCL	122.2
95% KM (z) UCL	110.6	95% KM Bootstrap t UCL	442.3
90% KM Chebyshev UCL	157.7	95% KM Chebyshev UCL	204.9
97.5% KM Chebyshev UCL	270.4	99% KM Chebyshev UCL	399.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.823	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.926	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.147	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.102	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.191	k star (bias corrected MLE)	0.192
Theta hat (MLE)	516	Theta star (bias corrected MLE)	513.4
nu hat (MLE)	36.71	nu star (bias corrected)	36.89
MLE Mean (bias corrected)	98.64	MLE Sd (bias corrected)	225

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0135	nu hat (KM)	4.796
Approximate Chi Square Value (4.80, α)	1.059	Adjusted Chi Square Value (4.80, β)	1.045
95% Gamma Approximate KM-UCL (use when n>=50)	242.3	95% Gamma Adjusted KM-UCL (use when n<50)	245.5

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0014	Mean	53.5
Maximum	6100	Median	0.01
SD	461	CV	8.616
k hat (MLE)	0.137	k star (bias corrected MLE)	0.138
Theta hat (MLE)	391.5	Theta star (bias corrected MLE)	387.4
nu hat (MLE)	48.38	nu star (bias corrected)	48.89
MLE Mean (bias corrected)	53.5	MLE Sd (bias corrected)	144
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (48.89, α)	33.84	Adjusted Chi Square Value (48.89, β)	33.74
95% Gamma Approximate UCL (use when n>=50)	77.3	95% Gamma Adjusted UCL (use when n<50)	77.54

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.0939	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0904	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	53.5	Mean in Log Scale	-2.759
SD in Original Scale	461	SD in Log Scale	4.765
95% t UCL (assumes normality of ROS data)	110.8	95% Percentile Bootstrap UCL	120.4
95% BCA Bootstrap UCL	196.9	95% Bootstrap t UCL	423.3
95% H-UCL (Log ROS)	60028		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	53.54	Mean in Log Scale	-1.832
SD in Original Scale	461	SD in Log Scale	4.19
95% t UCL (Assumes normality)	110.8	95% H-Stat UCL	6832

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 270.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chloroform

General Statistics

Total Number of Observations	177	Number of Distinct Observations	96
Number of Detects	1	Number of Non-Detects	176
Number of Distinct Detects	1	Number of Distinct Non-Detects	95

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Chloroform was not processed!

cis-1,2-Dichloroethene

General Statistics

Total Number of Observations	146	Number of Distinct Observations	86
Number of Detects	15	Number of Non-Detects	131
Number of Distinct Detects	14	Number of Distinct Non-Detects	75
Minimum Detect	0.0011	Minimum Non-Detect	6.9000E-4
Maximum Detect	4.9	Maximum Non-Detect	61
Variance Detects	1.556	Percent Non-Detects	89.73%
Mean Detects	0.405	SD Detects	1.247
Median Detects	0.04	CV Detects	3.081

Skewness Detects	3.832	Kurtosis Detects	14.77
Mean of Logged Detects	-3.299	SD of Logged Detects	2.331

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.346	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.451	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.229	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0464	Standard Error of Mean	0.0362
SD	0.414	95% KM (BCA) UCL	0.116
95% KM (t) UCL	0.106	95% KM (Percentile Bootstrap) UCL	0.114
95% KM (z) UCL	0.106	95% KM Bootstrap t UCL	0.557
90% KM Chebyshev UCL	0.155	95% KM Chebyshev UCL	0.204
97.5% KM Chebyshev UCL	0.273	99% KM Chebyshev UCL	0.407

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.142	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.84	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.245	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.241	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.29	k star (bias corrected MLE)	0.276
Theta hat (MLE)	1.398	Theta star (bias corrected MLE)	1.466
nu hat (MLE)	8.689	nu star (bias corrected)	8.284
MLE Mean (bias corrected)	0.405	MLE Sd (bias corrected)	0.77

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0125	nu hat (KM)	3.664
Approximate Chi Square Value (3.66, α)	0.594	Adjusted Chi Square Value (3.66, β)	0.583
95% Gamma Approximate KM-UCL (use when n>=50)	0.286	95% Gamma Adjusted KM-UCL (use when n<50)	0.292

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0011	Mean	0.0506
Maximum	4.9	Median	0.01
SD	0.406	CV	8.026
k hat (MLE)	0.437	k star (bias corrected MLE)	0.432
Theta hat (MLE)	0.116	Theta star (bias corrected MLE)	0.117
nu hat (MLE)	127.5	nu star (bias corrected)	126.2
MLE Mean (bias corrected)	0.0506	MLE Sd (bias corrected)	0.0769
		Adjusted Level of Significance (β)	0.0484
Approximate Chi Square Value (126.18, α)	101.2	Adjusted Chi Square Value (126.18, β)	101
95% Gamma Approximate UCL (use when n>=50)	0.063	95% Gamma Adjusted UCL (use when n<50)	0.0632

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.115	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.229	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0417	Mean in Log Scale	-9.87
SD in Original Scale	0.407	SD in Log Scale	2.939
95% t UCL (assumes normality of ROS data)	0.0974	95% Percentile Bootstrap UCL	0.107
95% BCA Bootstrap UCL	0.145	95% Bootstrap t UCL	0.663
95% H-UCL (Log ROS)	0.0116		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-6.625	95% H-UCL (KM -Log)	0.00715
KM SD (logged)	1.615	95% Critical H Value (KM-Log)	2.837
KM Standard Error of Mean (logged)	0.175		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.703	Mean in Log Scale	-4.193
SD in Original Scale	3.466	SD in Log Scale	2.849
95% t UCL (Assumes normality)	1.178	95% H-Stat UCL	2.453

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	0.273

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

cis-1,3-Dichloropropene

General Statistics

Total Number of Observations	175	Number of Distinct Observations	89
Number of Detects	2	Number of Non-Detects	173
Number of Distinct Detects	2	Number of Distinct Non-Detects	88
Minimum Detect	0.0064	Minimum Non-Detect	7.2000E-4
Maximum Detect	0.12	Maximum Non-Detect	63
Variance Detects	0.00645	Percent Non-Detects	98.86%
Mean Detects	0.0632	SD Detects	0.0803
Median Detects	0.0632	CV Detects	1.271
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-3.586	SD of Logged Detects	2.073

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.00187	Standard Error of Mean	0.00148
SD	0.0111	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.00431	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.0043	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.0063	95% KM Chebyshev UCL	0.00831
97.5% KM Chebyshev UCL	0.0111	99% KM Chebyshev UCL	0.0166

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.729	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0867	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	2.916	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.028	nu hat (KM)	9.814
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (9.81, α)	3.826	Adjusted Chi Square Value (9.81, β)	3.795
95% Gamma Approximate KM-UCL (use when n>=50)	0.00478	95% Gamma Adjusted KM-UCL (use when n<50)	0.00482

Gamma (KM) may not be used when k hat (KM) is < 0.1

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	7.2387E-4	Mean in Log Scale	-17.08
SD in Original Scale	0.00908	SD in Log Scale	3.286
95% t UCL (assumes normality of ROS data)	0.00186	95% Percentile Bootstrap UCL	0.00209
95% BCA Bootstrap UCL	0.00343	95% Bootstrap t UCL	0.849
95% H-UCL (Log ROS)	2.7988E-5		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.603	Mean in Log Scale	-3.999
SD in Original Scale	3.271	SD in Log Scale	2.791
95% t UCL (Assumes normality)	1.011	95% H-Stat UCL	2.176

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 0.0111

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Ethylbenzene

General Statistics

Total Number of Observations	177	Number of Distinct Observations	93

Number of Detects	38	Number of Non-Detects	139
Number of Distinct Detects	38	Number of Distinct Non-Detects	60
Minimum Detect	0.0018	Minimum Non-Detect	0.0013
Maximum Detect	460	Maximum Non-Detect	110
Variance Detects	8254	Percent Non-Detects	78.53%
Mean Detects	26.36	SD Detects	90.85
Median Detects	0.895	CV Detects	3.446
Skewness Detects	4.258	Kurtosis Detects	17.76
Mean of Logged Detects	-0.0646	SD of Logged Detects	2.994

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.319	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.938	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.418	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.144	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	5.69	Standard Error of Mean	3.27
SD	42.93	95% KM (BCA) UCL	12.46
95% KM (t) UCL	11.1	95% KM (Percentile Bootstrap) UCL	11.66
95% KM (z) UCL	11.07	95% KM Bootstrap t UCL	46.51
90% KM Chebyshev UCL	15.5	95% KM Chebyshev UCL	19.95
97.5% KM Chebyshev UCL	26.11	99% KM Chebyshev UCL	38.23

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.475	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.9	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.228	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.158	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.218	k star (bias corrected MLE)	0.218
Theta hat (MLE)	121.1	Theta star (bias corrected MLE)	120.9
nu hat (MLE)	16.54	nu star (bias corrected)	16.57
MLE Mean (bias corrected)	26.36	MLE Sd (bias corrected)	56.46

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0176	nu hat (KM)	6.221
Approximate Chi Square Value (6.22, α)	1.754	Adjusted Chi Square Value (6.22, β)	1.734
95% Gamma Approximate KM-UCL (use when n>=50)	20.19	95% Gamma Adjusted KM-UCL (use when n<50)	20.41

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0018	Mean	5.668
Maximum	460	Median	0.01
SD	43.05	CV	7.595
k hat (MLE)	0.144	k star (bias corrected MLE)	0.145
Theta hat (MLE)	39.33	Theta star (bias corrected MLE)	38.98
nu hat (MLE)	51.01	nu star (bias corrected)	51.48

MLE Mean (bias corrected)	5.668	MLE Sd (bias corrected)	14.86
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (51.48, α)	36	Adjusted Chi Square Value (51.48, β)	35.89
95% Gamma Approximate UCL (use when n>=50)	8.105	95% Gamma Adjusted UCL (use when n<50)	8.128

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.938	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0966	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.144	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.661	Mean in Log Scale	-7.258
SD in Original Scale	43.05	SD in Log Scale	4.618
95% t UCL (assumes normality of ROS data)	11.01	95% Percentile Bootstrap UCL	11.79
95% BCA Bootstrap UCL	13.95	95% Bootstrap t UCL	49.37
95% H-UCL (Log ROS)	290.8		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-5.018	95% H-UCL (KM -Log)	2.026
KM SD (logged)	3.061	95% Critical H Value (KM-Log)	4.502
KM Standard Error of Mean (logged)	0.247		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	6.559	Mean in Log Scale	-2.965
SD in Original Scale	43.31	SD in Log Scale	3.145
95% t UCL (Assumes normality)	11.94	95% H-Stat UCL	21.59

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 26.11

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Methylene chloride

General Statistics

Total Number of Observations	177	Number of Distinct Observations	82
Number of Detects	28	Number of Non-Detects	149
Number of Distinct Detects	25	Number of Distinct Non-Detects	68
Minimum Detect	0.0016	Minimum Non-Detect	0.0011
Maximum Detect	130	Maximum Non-Detect	100
Variance Detects	643	Percent Non-Detects	84.18%
Mean Detects	7.947	SD Detects	25.36
Median Detects	0.305	CV Detects	3.191
Skewness Detects	4.53	Kurtosis Detects	21.64
Mean of Logged Detects	-0.643	SD of Logged Detects	2.528

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.348	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.924	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.377	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.167	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.276	Standard Error of Mean	0.791
SD	10.33	95% KM (BCA) UCL	2.675
95% KM (t) UCL	2.584	95% KM (Percentile Bootstrap) UCL	2.763
95% KM (z) UCL	2.577	95% KM Bootstrap t UCL	9.443
90% KM Chebyshev UCL	3.649	95% KM Chebyshev UCL	4.724
97.5% KM Chebyshev UCL	6.216	99% KM Chebyshev UCL	9.147

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.472	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.874	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.281	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.181	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.26	k star (bias corrected MLE)	0.256
Theta hat (MLE)	30.58	Theta star (bias corrected MLE)	31.06
nu hat (MLE)	14.55	nu star (bias corrected)	14.33
MLE Mean (bias corrected)	7.947	MLE Sd (bias corrected)	15.71

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0153	nu hat (KM)	5.402
Approximate Chi Square Value (5.40, α)	1.342	Adjusted Chi Square Value (5.40, β)	1.326
95% Gamma Approximate KM-UCL (use when n>=50)	5.134	95% Gamma Adjusted KM-UCL (use when n<50)	5.196

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0016	Mean	1.266
Maximum	130	Median	0.01
SD	10.35	CV	8.177
k hat (MLE)	0.178	k star (bias corrected MLE)	0.179
Theta hat (MLE)	7.116	Theta star (bias corrected MLE)	7.086
nu hat (MLE)	62.95	nu star (bias corrected)	63.22
MLE Mean (bias corrected)	1.266	MLE Sd (bias corrected)	2.995
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (63.22, α)	45.93	Adjusted Chi Square Value (63.22, β)	45.81
95% Gamma Approximate UCL (use when n>=50)	1.742	95% Gamma Adjusted UCL (use when n<50)	1.747

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.924	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**	

5% Lilliefors Critical Value	0.167	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.258	Mean in Log Scale	-7.457
SD in Original Scale	10.35	SD in Log Scale	3.771
95% t UCL (assumes normality of ROS data)	2.544	95% Percentile Bootstrap UCL	2.645
95% BCA Bootstrap UCL	3.958	95% Bootstrap t UCL	9.566
95% H-UCL (Log ROS)	3.293		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.066	Mean in Log Scale	-3.346
SD in Original Scale	11.47	SD in Log Scale	2.958
95% t UCL (Assumes normality)	3.491	95% H-Stat UCL	7.41

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	6.216

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Tetrachloroethene

General Statistics

Total Number of Observations	177	Number of Distinct Observations	93
Number of Detects	9	Number of Non-Detects	168
Number of Distinct Detects	9	Number of Distinct Non-Detects	88
Minimum Detect	0.0012	Minimum Non-Detect	6.5000E-4
Maximum Detect	2	Maximum Non-Detect	57
Variance Detects	0.454	Percent Non-Detects	94.92%
Mean Detects	0.549	SD Detects	0.673
Median Detects	0.38	CV Detects	1.226
Skewness Detects	1.456	Kurtosis Detects	1.814
Mean of Logged Detects	-2.499	SD of Logged Detects	3.086

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.213	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.295	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0313	Standard Error of Mean	0.016
SD	0.194	95% KM (BCA) UCL	0.0603
95% KM (t) UCL	0.0578	95% KM (Percentile Bootstrap) UCL	0.0577
95% KM (z) UCL	0.0576	95% KM Bootstrap t UCL	0.0918
90% KM Chebyshev UCL	0.0793	95% KM Chebyshev UCL	0.101

97.5% KM Chebyshev UCL	0.131	99% KM Chebyshev UCL	0.191

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.541	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.798	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.223	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.299	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.353	k star (bias corrected MLE)	0.31
Theta hat (MLE)	1.555	Theta star (bias corrected MLE)	1.774
nu hat (MLE)	6.36	nu star (bias corrected)	5.573
MLE Mean (bias corrected)	0.549	MLE Sd (bias corrected)	0.987

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0261	nu hat (KM)	9.238
Approximate Chi Square Value (9.24, α)	3.471	Adjusted Chi Square Value (9.24, β)	3.443
95% Gamma Approximate KM-UCL (use when n>=50)	0.0833	95% Gamma Adjusted KM-UCL (use when n<50)	0.084

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0012	Mean	0.0374
Maximum	2	Median	0.01
SD	0.186	CV	4.98
k hat (MLE)	0.521	k star (bias corrected MLE)	0.515
Theta hat (MLE)	0.0719	Theta star (bias corrected MLE)	0.0726
nu hat (MLE)	184.3	nu star (bias corrected)	182.5
MLE Mean (bias corrected)	0.0374	MLE Sd (bias corrected)	0.0521
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (182.47, α)	152.2	Adjusted Chi Square Value (182.47, β)	152
95% Gamma Approximate UCL (use when n>=50)	0.0449	95% Gamma Adjusted UCL (use when n<50)	0.0449

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.805	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.295	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0279	Mean in Log Scale	-14.7
SD in Original Scale	0.188	SD in Log Scale	4.105
95% t UCL (assumes normality of ROS data)	0.0513	95% Percentile Bootstrap UCL	0.0528
95% BCA Bootstrap UCL	0.0681	95% Bootstrap t UCL	0.0866
95% H-UCL (Log ROS)	0.0115		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-7.027	95% H-UCL (KM -Log)	0.00276
KM SD (logged)	1.332	95% Critical H Value (KM-Log)	2.477
KM Standard Error of Mean (logged)	0.116		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.566	Mean in Log Scale	-3.954
SD in Original Scale	2.937	SD in Log Scale	2.844
95% t UCL (Assumes normality)	0.931	95% H-Stat UCL	2.712

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0578	95% KM (Percentile Bootstrap) UCL	0.0577

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Toluene

General Statistics

Total Number of Observations	177	Number of Distinct Observations	123
Number of Detects	117	Number of Non-Detects	60
Number of Distinct Detects	99	Number of Distinct Non-Detects	27
Minimum Detect	0.0013	Minimum Non-Detect	7.2000E-4
Maximum Detect	56000	Maximum Non-Detect	1.3
Variance Detects	30727933	Percent Non-Detects	33.9%
Mean Detects	935.7	SD Detects	5543
Median Detects	1.7	CV Detects	5.924
Skewness Detects	8.864	Kurtosis Detects	85.94
Mean of Logged Detects	0.65	SD of Logged Detects	4.281

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.191	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.439	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0819	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	618.5	Standard Error of Mean	340.4
SD	4509	95% KM (BCA) UCL	1274
95% KM (t) UCL	1181	95% KM (Percentile Bootstrap) UCL	1254
95% KM (z) UCL	1178	95% KM Bootstrap t UCL	2539
90% KM Chebyshev UCL	1640	95% KM Chebyshev UCL	2102
97.5% KM Chebyshev UCL	2744	99% KM Chebyshev UCL	4005

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	9.916	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.989	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.218	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.0968	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.127	k star (bias corrected MLE)	0.13

Theta hat (MLE)	7363	Theta star (bias corrected MLE)	7224
nu hat (MLE)	29.74	nu star (bias corrected)	30.31
MLE Mean (bias corrected)	935.7	MLE Sd (bias corrected)	2600

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0188	nu hat (KM)	6.66
Approximate Chi Square Value (6.66, α)	1.986	Adjusted Chi Square Value (6.66, β)	1.965
95% Gamma Approximate KM-UCL (use when n>=50)	2074	95% Gamma Adjusted KM-UCL (use when n<50)	2096

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0013	Mean	618.5
Maximum	56000	Median	0.14
SD	4522	CV	7.311
k hat (MLE)	0.107	k star (bias corrected MLE)	0.109
Theta hat (MLE)	5804	Theta star (bias corrected MLE)	5699
nu hat (MLE)	37.73	nu star (bias corrected)	38.42
MLE Mean (bias corrected)	618.5	MLE Sd (bias corrected)	1877
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (38.42, α)	25.23	Adjusted Chi Square Value (38.42, β)	25.14
95% Gamma Approximate UCL (use when n>=50)	942.1	95% Gamma Adjusted UCL (use when n<50)	945.4

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.0673	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0819	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	618.5	Mean in Log Scale	-2.404
SD in Original Scale	4522	SD in Log Scale	5.669
95% t UCL (assumes normality of ROS data)	1181	95% Percentile Bootstrap UCL	1253
95% BCA Bootstrap UCL	1700	95% Bootstrap t UCL	2458
95% H-UCL (Log ROS)	25388087		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-1.882	95% H-UCL (KM -Log)	528731
KM SD (logged)	4.985	95% Critical H Value (KM-Log)	7.007
KM Standard Error of Mean (logged)	0.379		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	618.5	Mean in Log Scale	-1.424
SD in Original Scale	4522	SD in Log Scale	4.721
95% t UCL (Assumes normality)	1181	95% H-Stat UCL	177772

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 2744

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Trichloroethene

General Statistics

Total Number of Observations	177	Number of Distinct Observations	87
Number of Detects	8	Number of Non-Detects	169
Number of Distinct Detects	8	Number of Distinct Non-Detects	82
Minimum Detect	0.0014	Minimum Non-Detect	6.5000E-4
Maximum Detect	0.44	Maximum Non-Detect	57
Variance Detects	0.0331	Percent Non-Detects	95.48%
Mean Detects	0.14	SD Detects	0.182
Median Detects	0.0263	CV Detects	1.301
Skewness Detects	0.823	Kurtosis Detects	-1.363
Mean of Logged Detects	-3.738	SD of Logged Detects	2.477

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.761	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.326	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.313	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.00813	Standard Error of Mean	0.00419
SD	0.049	95% KM (BCA) UCL	0.0158
95% KM (t) UCL	0.0151	95% KM (Percentile Bootstrap) UCL	0.015
95% KM (z) UCL	0.015	95% KM Bootstrap t UCL	0.0183
90% KM Chebyshev UCL	0.0207	95% KM Chebyshev UCL	0.0264
97.5% KM Chebyshev UCL	0.0343	99% KM Chebyshev UCL	0.0499

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.613	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.784	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.23	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.375	k star (bias corrected MLE)	0.318
Theta hat (MLE)	0.372	Theta star (bias corrected MLE)	0.44
nu hat (MLE)	6.007	nu star (bias corrected)	5.088
MLE Mean (bias corrected)	0.14	MLE Sd (bias corrected)	0.248

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0275	nu hat (KM)	9.726
Approximate Chi Square Value (9.73, α)	3.771	Adjusted Chi Square Value (9.73, β)	3.741
95% Gamma Approximate KM-UCL (use when n>=50)	0.021	95% Gamma Adjusted KM-UCL (use when n<50)	0.0211

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0014	Mean	0.0159
Maximum	0.44	Median	0.01
SD	0.0452	CV	2.852
k hat (MLE)	1.325	k star (bias corrected MLE)	1.307
Theta hat (MLE)	0.012	Theta star (bias corrected MLE)	0.0121
nu hat (MLE)	469.2	nu star (bias corrected)	462.6
MLE Mean (bias corrected)	0.0159	MLE Sd (bias corrected)	0.0139
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (462.56, α)	413.7	Adjusted Chi Square Value (462.56, β)	413.3
95% Gamma Approximate UCL (use when n>=50)	0.0177	95% Gamma Adjusted UCL (use when n<50)	0.0178

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.313	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00635	Mean in Log Scale	-13
SD in Original Scale	0.0465	SD in Log Scale	3.243
95% t UCL (assumes normality of ROS data)	0.0121	95% Percentile Bootstrap UCL	0.0131
95% BCA Bootstrap UCL	0.0145	95% Bootstrap t UCL	0.0158
95% H-UCL (Log ROS)	0.00139		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-7.064	95% H-UCL (KM -Log)	0.00175
KM SD (logged)	1.043	95% Critical H Value (KM-Log)	2.204
KM Standard Error of Mean (logged)	0.108		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.528	Mean in Log Scale	-4.152
SD in Original Scale	2.938	SD in Log Scale	2.672
95% t UCL (Assumes normality)	0.893	95% H-Stat UCL	1.252

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0151	95% GROS Approximate Gamma UCL	0.0177
95% Approximate Gamma KM-UCL	0.021		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Vinyl chloride

General Statistics

Total Number of Observations	177	Number of Distinct Observations	90

Number of Detects	16	Number of Non-Detects	161
Number of Distinct Detects	16	Number of Distinct Non-Detects	79
Minimum Detect	0.0017	Minimum Non-Detect	0.0011
Maximum Detect	3.3	Maximum Non-Detect	100
Variance Detects	0.667	Percent Non-Detects	90.96%
Mean Detects	0.241	SD Detects	0.817
Median Detects	0.023	CV Detects	3.389
Skewness Detects	3.984	Kurtosis Detects	15.91
Mean of Logged Detects	-3.722	SD of Logged Detects	1.869

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.311	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.496	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.222	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0265	Standard Error of Mean	0.0205
SD	0.255	95% KM (BCA) UCL	0.0672
95% KM (t) UCL	0.0604	95% KM (Percentile Bootstrap) UCL	0.0663
95% KM (z) UCL	0.0602	95% KM Bootstrap t UCL	0.339
90% KM Chebyshev UCL	0.088	95% KM Chebyshev UCL	0.116
97.5% KM Chebyshev UCL	0.155	99% KM Chebyshev UCL	0.231

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.133	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.838	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.328	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.233	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.3	k star (bias corrected MLE)	0.285
Theta hat (MLE)	0.803	Theta star (bias corrected MLE)	0.844
nu hat (MLE)	9.598	nu star (bias corrected)	9.132
MLE Mean (bias corrected)	0.241	MLE Sd (bias corrected)	0.451

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0107	nu hat (KM)	3.801
Approximate Chi Square Value (3.80, α)	0.645	Adjusted Chi Square Value (3.80, β)	0.635
95% Gamma Approximate KM-UCL (use when n>=50)	0.156	95% Gamma Adjusted KM-UCL (use when n<50)	0.159

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0017	Mean	0.0309
Maximum	3.3	Median	0.01
SD	0.248	CV	8.015
k hat (MLE)	0.591	k star (bias corrected MLE)	0.585
Theta hat (MLE)	0.0522	Theta star (bias corrected MLE)	0.0528
nu hat (MLE)	209.2	nu star (bias corrected)	207

MLE Mean (bias corrected)	0.0309	MLE Sd (bias corrected)	0.0404
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (207.02, α)	174.7	Adjusted Chi Square Value (207.02, β)	174.5
95% Gamma Approximate UCL (use when n>=50)	0.0366	95% Gamma Adjusted UCL (use when n<50)	0.0366

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.133	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.222	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0222	Mean in Log Scale	-8.19
SD in Original Scale	0.248	SD in Log Scale	2.058
95% t UCL (assumes normality of ROS data)	0.053	95% Percentile Bootstrap UCL	0.0595
95% BCA Bootstrap UCL	0.0791	95% Bootstrap t UCL	0.474
95% H-UCL (Log ROS)	0.00383		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-6.208	95% H-UCL (KM -Log)	0.00599
KM SD (logged)	1.303	95% Critical H Value (KM-Log)	2.448
KM Standard Error of Mean (logged)	0.151		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.93	Mean in Log Scale	-3.655
SD in Original Scale	5.189	SD in Log Scale	2.49
95% t UCL (Assumes normality)	1.575	95% H-Stat UCL	1.169

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.116

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Xylenes

General Statistics

Total Number of Observations	174	Number of Distinct Observations	109
Number of Detects	96	Number of Non-Detects	78
Number of Distinct Detects	79	Number of Distinct Non-Detects	32
Minimum Detect	0.0015	Minimum Non-Detect	9.3000E-4
Maximum Detect	2500	Maximum Non-Detect	1.1
Variance Detects	158314	Percent Non-Detects	44.83%
Mean Detects	102.3	SD Detects	397.9
Median Detects	1.45	CV Detects	3.889
Skewness Detects	5.058	Kurtosis Detects	26.32
Mean of Logged Detects	0.18	SD of Logged Detects	3.519

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.292	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.425	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0904	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	56.45	Standard Error of Mean	22.74
SD	298.4	95% KM (BCA) UCL	102.8
95% KM (t) UCL	94.06	95% KM (Percentile Bootstrap) UCL	99.03
95% KM (z) UCL	93.86	95% KM Bootstrap t UCL	126.5
90% KM Chebyshev UCL	124.7	95% KM Chebyshev UCL	155.6
97.5% KM Chebyshev UCL	198.5	99% KM Chebyshev UCL	282.7

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	6.8	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.947	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.221	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.102	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.17	k star (bias corrected MLE)	0.171
Theta hat (MLE)	603.1	Theta star (bias corrected MLE)	597.3
nu hat (MLE)	32.57	nu star (bias corrected)	32.89
MLE Mean (bias corrected)	102.3	MLE Sd (bias corrected)	247.2

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0358	nu hat (KM)	12.46
Approximate Chi Square Value (12.46, α)	5.53	Adjusted Chi Square Value (12.46, β)	5.492
95% Gamma Approximate KM-UCL (use when n>=50)	127.2	95% Gamma Adjusted KM-UCL (use when n<50)	128.1

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0015	Mean	56.45
Maximum	2500	Median	0.01
SD	299.2	CV	5.3
k hat (MLE)	0.131	k star (bias corrected MLE)	0.132
Theta hat (MLE)	432.1	Theta star (bias corrected MLE)	426.9
nu hat (MLE)	45.47	nu star (bias corrected)	46.02
MLE Mean (bias corrected)	56.45	MLE Sd (bias corrected)	155.2
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (46.02, α)	31.46	Adjusted Chi Square Value (46.02, β)	31.36
95% Gamma Approximate UCL (use when n>=50)	82.59	95% Gamma Adjusted UCL (use when n<50)	82.86

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.0673	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0904	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	56.45	Mean in Log Scale	-3.304
SD in Original Scale	299.2	SD in Log Scale	4.887
95% t UCL (assumes normality of ROS data)	93.96	95% Percentile Bootstrap UCL	95.51
95% BCA Bootstrap UCL	114.9	95% Bootstrap t UCL	118.4
95% H-UCL (Log ROS)	72144		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.81	95% H-UCL (KM -Log)	4635
KM SD (logged)	4.302	95% Critical H Value (KM-Log)	6.104
KM Standard Error of Mean (logged)	0.335		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	56.47	Mean in Log Scale	-2.139
SD in Original Scale	299.2	SD in Log Scale	4.026
95% t UCL (Assumes normality)	93.99	95% H-Stat UCL	2261

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 198.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1-Methylnaphthalene

General Statistics

Total Number of Observations	134	Number of Distinct Observations	48
Number of Detects	39	Number of Non-Detects	95
Number of Distinct Detects	35	Number of Distinct Non-Detects	17
Minimum Detect	0.019	Minimum Non-Detect	0.017
Maximum Detect	47	Maximum Non-Detect	0.22
Variance Detects	106.5	Percent Non-Detects	70.9%
Mean Detects	2.886	SD Detects	10.32
Median Detects	0.14	CV Detects	3.576
Skewness Detects	4.173	Kurtosis Detects	16.42
Mean of Logged Detects	-1.381	SD of Logged Detects	1.825

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.293	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.939	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.451	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.142	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.854	Standard Error of Mean	0.494
SD	5.648	95% KM (BCA) UCL	1.877
95% KM (t) UCL	1.673	95% KM (Percentile Bootstrap) UCL	1.827
95% KM (z) UCL	1.667	95% KM Bootstrap t UCL	9.215

90% KM Chebyshev UCL	2.337	95% KM Chebyshev UCL	3.008
97.5% KM Chebyshev UCL	3.941	99% KM Chebyshev UCL	5.772

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.56	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.865	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.298	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.154	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.285	k star (bias corrected MLE)	0.28
Theta hat (MLE)	10.13	Theta star (bias corrected MLE)	10.3
nu hat (MLE)	22.22	nu star (bias corrected)	21.85
MLE Mean (bias corrected)	2.886	MLE Sd (bias corrected)	5.453

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0228	nu hat (KM)	6.124
Approximate Chi Square Value (6.12, α)	1.703	Adjusted Chi Square Value (6.12, β)	1.678
95% Gamma Approximate KM-UCL (use when n>=50)	3.069	95% Gamma Adjusted KM-UCL (use when n<50)	3.115

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.847
Maximum	47	Median	0.01
SD	5.67	CV	6.694
k hat (MLE)	0.209	k star (bias corrected MLE)	0.209
Theta hat (MLE)	4.057	Theta star (bias corrected MLE)	4.051
nu hat (MLE)	55.96	nu star (bias corrected)	56.04
MLE Mean (bias corrected)	0.847	MLE Sd (bias corrected)	1.852
		Adjusted Level of Significance (β)	0.0482
Approximate Chi Square Value (56.04, α)	39.84	Adjusted Chi Square Value (56.04, β)	39.69
95% Gamma Approximate UCL (use when n>=50)	1.192	95% Gamma Adjusted UCL (use when n<50)	1.196

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.939	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.149	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.142	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.843	Mean in Log Scale	-5.151
SD in Original Scale	5.671	SD in Log Scale	3.065
95% t UCL (assumes normality of ROS data)	1.655	95% Percentile Bootstrap UCL	1.809
95% BCA Bootstrap UCL	2.236	95% Bootstrap t UCL	9.011
95% H-UCL (Log ROS)	2.168		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.857	Mean in Log Scale	-3.096

SD in Original Scale	5.669	SD in Log Scale	1.492
95% t UCL (Assumes normality)	1.668	95% H-Stat UCL	0.195

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 3.008

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

2-Chlorophenol

General Statistics

Total Number of Observations	167	Number of Distinct Observations	40
Number of Detects	4	Number of Non-Detects	163
Number of Distinct Detects	4	Number of Distinct Non-Detects	37
Minimum Detect	0.12	Minimum Non-Detect	0.01
Maximum Detect	3.4	Maximum Non-Detect	0.54
Variance Detects	2.438	Percent Non-Detects	97.6%
Mean Detects	1.065	SD Detects	1.561
Median Detects	0.37	CV Detects	1.466
Skewness Detects	1.963	Kurtosis Detects	3.883
Mean of Logged Detects	-0.724	SD of Logged Detects	1.405

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.703	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.413	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.443	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0363	Standard Error of Mean	0.0237
SD	0.265	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.0756	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.0754	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.108	95% KM Chebyshev UCL	0.14
97.5% KM Chebyshev UCL	0.185	99% KM Chebyshev UCL	0.272

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.495	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.67	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.372	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.405	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.759	k star (bias corrected MLE)	0.356
Theta hat (MLE)	1.403	Theta star (bias corrected MLE)	2.988
nu hat (MLE)	6.074	nu star (bias corrected)	2.852

MLE Mean (bias corrected)	1.065	MLE Sd (bias corrected)	1.784

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0188	nu hat (KM)	6.294
Approximate Chi Square Value (6.29, α)	1.792	Adjusted Chi Square Value (6.29, β)	1.772
95% Gamma Approximate KM-UCL (use when n>=50)	0.128	95% Gamma Adjusted KM-UCL (use when n<50)	0.129

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0353
Maximum	3.4	Median	0.01
SD	0.265	CV	7.514
k hat (MLE)	0.538	k star (bias corrected MLE)	0.532
Theta hat (MLE)	0.0656	Theta star (bias corrected MLE)	0.0663
nu hat (MLE)	179.7	nu star (bias corrected)	177.8
MLE Mean (bias corrected)	0.0353	MLE Sd (bias corrected)	0.0483
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (177.79, α)	148	Adjusted Chi Square Value (177.79, β)	147.7
95% Gamma Approximate UCL (use when n>=50)	0.0424	95% Gamma Adjusted UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.297	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.443	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0261	Mean in Log Scale	-10.03
SD in Original Scale	0.266	SD in Log Scale	3.124
95% t UCL (assumes normality of ROS data)	0.0601	95% Percentile Bootstrap UCL	0.0667
95% BCA Bootstrap UCL	0.105	95% Bootstrap t UCL	0.271
95% H-UCL (Log ROS)	0.0176		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-4.499	95% H-UCL (KM -Log)	0.0152
KM SD (logged)	0.654	95% Critical H Value (KM-Log)	1.901
KM Standard Error of Mean (logged)	0.0619		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0918	Mean in Log Scale	-3.142
SD in Original Scale	0.271	SD in Log Scale	1.012
95% t UCL (Assumes normality)	0.126	95% H-Stat UCL	0.0855

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0756	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

2-Methylnaphthalene

General Statistics

Total Number of Observations	167	Number of Distinct Observations	64
Number of Detects	43	Number of Non-Detects	124
Number of Distinct Detects	41	Number of Distinct Non-Detects	26
Minimum Detect	0.027	Minimum Non-Detect	0.017
Maximum Detect	120	Maximum Non-Detect	0.47
Variance Detects	596.5	Percent Non-Detects	74.25%
Mean Detects	6.148	SD Detects	24.42
Median Detects	0.26	CV Detects	3.973
Skewness Detects	4.437	Kurtosis Detects	18.73
Mean of Logged Detects	-0.905	SD of Logged Detects	1.8

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.265	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.943	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.478	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.604	Standard Error of Mean	0.982
SD	12.54	95% KM (BCA) UCL	3.589
95% KM (t) UCL	3.228	95% KM (Percentile Bootstrap) UCL	3.498
95% KM (z) UCL	3.219	95% KM Bootstrap t UCL	20.15
90% KM Chebyshev UCL	4.549	95% KM Chebyshev UCL	5.883
97.5% KM Chebyshev UCL	7.735	99% KM Chebyshev UCL	11.37

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	7.369	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.881	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.335	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.148	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.259	k star (bias corrected MLE)	0.257
Theta hat (MLE)	23.69	Theta star (bias corrected MLE)	23.93
nu hat (MLE)	22.32	nu star (bias corrected)	22.09
MLE Mean (bias corrected)	6.148	MLE Sd (bias corrected)	12.13

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0164	nu hat (KM)	5.47
Approximate Chi Square Value (5.47, α)	1.375	Adjusted Chi Square Value (5.47, β)	1.358
95% Gamma Approximate KM-UCL (use when n>=50)	6.381	95% Gamma Adjusted KM-UCL (use when n<50)	6.463

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.59
Maximum	120	Median	0.01
SD	12.58	CV	7.908
k hat (MLE)	0.181	k star (bias corrected MLE)	0.182
Theta hat (MLE)	8.763	Theta star (bias corrected MLE)	8.728
nu hat (MLE)	60.62	nu star (bias corrected)	60.86
MLE Mean (bias corrected)	1.59	MLE Sd (bias corrected)	3.726
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (60.86, α)	43.92	Adjusted Chi Square Value (60.86, β)	43.79
95% Gamma Approximate UCL (use when n>=50)	2.204	95% Gamma Adjusted UCL (use when n<50)	2.21

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.943	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.589	Mean in Log Scale	-4.747
SD in Original Scale	12.58	SD in Log Scale	2.925
95% t UCL (assumes normality of ROS data)	3.199	95% Percentile Bootstrap UCL	3.275
95% BCA Bootstrap UCL	4.45	95% Bootstrap t UCL	29.61
95% H-UCL (Log ROS)	1.665		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.635	Mean in Log Scale	-2.645
SD in Original Scale	12.57	SD in Log Scale	1.623
95% t UCL (Assumes normality)	3.244	95% H-Stat UCL	0.375

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 5.883

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

3 & 4 Methylphenol

General Statistics

Total Number of Observations	134	Number of Distinct Observations	50
Number of Detects	26	Number of Non-Detects	108
Number of Distinct Detects	25	Number of Distinct Non-Detects	27
Minimum Detect	0.049	Minimum Non-Detect	0.01

Maximum Detect	4	Maximum Non-Detect	0.54
Variance Detects	0.874	Percent Non-Detects	80.6%
Mean Detects	0.783	SD Detects	0.935
Median Detects	0.5	CV Detects	1.194
Skewness Detects	2.521	Kurtosis Detects	6.536
Mean of Logged Detects	-0.747	SD of Logged Detects	1.023

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.677	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.216	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.174	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.162	Standard Error of Mean	0.0446
SD	0.506	95% KM (BCA) UCL	0.255
95% KM (t) UCL	0.235	95% KM (Percentile Bootstrap) UCL	0.239
95% KM (z) UCL	0.235	95% KM Bootstrap t UCL	0.277
90% KM Chebyshev UCL	0.295	95% KM Chebyshev UCL	0.356
97.5% KM Chebyshev UCL	0.44	99% KM Chebyshev UCL	0.605

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.574	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.77	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.109	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.176	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.132	k star (bias corrected MLE)	1.027
Theta hat (MLE)	0.692	Theta star (bias corrected MLE)	0.762
nu hat (MLE)	58.86	nu star (bias corrected)	53.4
MLE Mean (bias corrected)	0.783	MLE Sd (bias corrected)	0.773

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.102	nu hat (KM)	27.3
Approximate Chi Square Value (27.30, α)	16.38	Adjusted Chi Square Value (27.30, β)	16.29
95% Gamma Approximate KM-UCL (use when n>=50)	0.269	95% Gamma Adjusted KM-UCL (use when n<50)	0.271

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.16
Maximum	4	Median	0.01
SD	0.508	CV	3.177
k hat (MLE)	0.335	k star (bias corrected MLE)	0.332
Theta hat (MLE)	0.478	Theta star (bias corrected MLE)	0.482
nu hat (MLE)	89.69	nu star (bias corrected)	89.02
MLE Mean (bias corrected)	0.16	MLE Sd (bias corrected)	0.278
		Adjusted Level of Significance (β)	0.0482
Approximate Chi Square Value (89.02, α)	68.26	Adjusted Chi Square Value (89.02, β)	68.07
95% Gamma Approximate UCL (use when n>=50)	0.209	95% Gamma Adjusted UCL (use when n<50)	0.209

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.984	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0929	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.174	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.167	Mean in Log Scale	-3.875
SD in Original Scale	0.507	SD in Log Scale	1.975
95% t UCL (assumes normality of ROS data)	0.24	95% Percentile Bootstrap UCL	0.245
95% BCA Bootstrap UCL	0.268	95% Bootstrap t UCL	0.29
95% H-UCL (Log ROS)	0.254		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.805	95% H-UCL (KM -Log)	0.116
KM SD (logged)	1.592	95% Critical H Value (KM-Log)	2.796
KM Standard Error of Mean (logged)	0.149		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.177	Mean in Log Scale	-3.07
SD in Original Scale	0.504	SD in Log Scale	1.297
95% t UCL (Assumes normality)	0.249	95% H-Stat UCL	0.142

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.235	95% GROS Approximate Gamma UCL	0.209
95% Approximate Gamma KM-UCL	0.269		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

4-Methylphenol (p-cresol)

General Statistics

Total Number of Observations	33	Number of Distinct Observations	15
Number of Detects	7	Number of Non-Detects	26
Number of Distinct Detects	6	Number of Distinct Non-Detects	10
Minimum Detect	0.4	Minimum Non-Detect	0.38
Maximum Detect	1.5	Maximum Non-Detect	0.47
Variance Detects	0.184	Percent Non-Detects	78.79%
Mean Detects	0.94	SD Detects	0.429
Median Detects	0.86	CV Detects	0.456
Skewness Detects	0.068	Kurtosis Detects	-1.939
Mean of Logged Detects	-0.164	SD of Logged Detects	0.505

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.228	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.335	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.501	Standard Error of Mean	0.055
SD	0.292	95% KM (BCA) UCL	0.612
95% KM (t) UCL	0.594	95% KM (Percentile Bootstrap) UCL	0.594
95% KM (z) UCL	0.591	95% KM Bootstrap t UCL	0.599
90% KM Chebyshev UCL	0.666	95% KM Chebyshev UCL	0.741
97.5% KM Chebyshev UCL	0.844	99% KM Chebyshev UCL	1.048

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.34	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.249	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	5.06	k star (bias corrected MLE)	2.987
Theta hat (MLE)	0.186	Theta star (bias corrected MLE)	0.315
nu hat (MLE)	70.84	nu star (bias corrected)	41.81
MLE Mean (bias corrected)	0.94	MLE Sd (bias corrected)	0.544

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	2.937	nu hat (KM)	193.9
Approximate Chi Square Value (193.86, α)	162.6	Adjusted Chi Square Value (193.86, β)	161.2
95% Gamma Approximate KM-UCL (use when n>=50)	0.597	95% Gamma Adjusted KM-UCL (use when n<50)	0.602

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.224
Maximum	1.5	Median	0.01
SD	0.424	CV	1.893
k hat (MLE)	0.366	k star (bias corrected MLE)	0.353
Theta hat (MLE)	0.612	Theta star (bias corrected MLE)	0.634
nu hat (MLE)	24.16	nu star (bias corrected)	23.3
MLE Mean (bias corrected)	0.224	MLE Sd (bias corrected)	0.377
		Adjusted Level of Significance (β)	0.0419
Approximate Chi Square Value (23.30, α)	13.32	Adjusted Chi Square Value (23.30, β)	12.93
95% Gamma Approximate UCL (use when n>=50)	0.392	95% Gamma Adjusted UCL (use when n<50)	0.403

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.335	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.322	Mean in Log Scale	-1.608
SD in Original Scale	0.382	SD in Log Scale	0.928
95% t UCL (assumes normality of ROS data)	0.435	95% Percentile Bootstrap UCL	0.441
95% BCA Bootstrap UCL	0.461	95% Bootstrap t UCL	0.476
95% H-UCL (Log ROS)	0.453		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.792	95% H-UCL (KM -Log)	0.556
KM SD (logged)	0.391	95% Critical H Value (KM-Log)	1.855
KM Standard Error of Mean (logged)	0.0737		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.367	Mean in Log Scale	-1.257
SD in Original Scale	0.355	SD in Log Scale	0.618
95% t UCL (Assumes normality)	0.471	95% H-Stat UCL	0.43

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.594	95% KM (Percentile Bootstrap) UCL	0.594

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Anthracene

General Statistics

Total Number of Observations	167	Number of Distinct Observations	72
Number of Detects	48	Number of Non-Detects	119
Number of Distinct Detects	41	Number of Distinct Non-Detects	33
Minimum Detect	0.08	Minimum Non-Detect	0.012
Maximum Detect	140	Maximum Non-Detect	0.47
Variance Detects	446.6	Percent Non-Detects	71.26%
Mean Detects	5.834	SD Detects	21.13
Median Detects	0.32	CV Detects	3.622
Skewness Detects	5.772	Kurtosis Detects	36.23
Mean of Logged Detects	-0.517	SD of Logged Detects	1.787

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.307	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.947	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.404	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.128	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.694	Standard Error of Mean	0.901
SD	11.52	95% KM (BCA) UCL	3.423
95% KM (t) UCL	3.183	95% KM (Percentile Bootstrap) UCL	3.368
95% KM (z) UCL	3.175	95% KM Bootstrap t UCL	6.574

90% KM Chebyshev UCL	4.395	95% KM Chebyshev UCL	5.619
97.5% KM Chebyshev UCL	7.317	99% KM Chebyshev UCL	10.65

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	6.749	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.862	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.31	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.139	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.302	k star (bias corrected MLE)	0.297
Theta hat (MLE)	19.32	Theta star (bias corrected MLE)	19.64
nu hat (MLE)	28.99	nu star (bias corrected)	28.51
MLE Mean (bias corrected)	5.834	MLE Sd (bias corrected)	10.7

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0216	nu hat (KM)	7.226
Approximate Chi Square Value (7.23, α)	2.296	Adjusted Chi Square Value (7.23, β)	2.272
95% Gamma Approximate KM-UCL (use when n>=50)	5.332	95% Gamma Adjusted KM-UCL (use when n<50)	5.388

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.684
Maximum	140	Median	0.01
SD	11.55	CV	6.859
k hat (MLE)	0.188	k star (bias corrected MLE)	0.189
Theta hat (MLE)	8.956	Theta star (bias corrected MLE)	8.927
nu hat (MLE)	62.8	nu star (bias corrected)	63.01
MLE Mean (bias corrected)	1.684	MLE Sd (bias corrected)	3.877
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (63.01, α)	45.75	Adjusted Chi Square Value (63.01, β)	45.62
95% Gamma Approximate UCL (use when n>=50)	2.319	95% Gamma Adjusted UCL (use when n<50)	2.326

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.846	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.947	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.179	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.128	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.685	Mean in Log Scale	-4.201
SD in Original Scale	11.55	SD in Log Scale	2.916
95% t UCL (assumes normality of ROS data)	3.163	95% Percentile Bootstrap UCL	3.311
95% BCA Bootstrap UCL	4.511	95% Bootstrap t UCL	6.593
95% H-UCL (Log ROS)	2.783		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.734	Mean in Log Scale	-2.274

SD in Original Scale	11.54	SD in Log Scale	1.663
95% t UCL (Assumes normality)	3.212	95% H-Stat UCL	0.59

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 5.619

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benzo(a)anthracene

General Statistics

Total Number of Observations	167	Number of Distinct Observations	71
Number of Detects	56	Number of Non-Detects	111
Number of Distinct Detects	48	Number of Distinct Non-Detects	26
Minimum Detect	0.081	Minimum Non-Detect	0.018
Maximum Detect	110	Maximum Non-Detect	0.47
Variance Detects	276.1	Percent Non-Detects	66.47%
Mean Detects	6.021	SD Detects	16.62
Median Detects	0.925	CV Detects	2.76
Skewness Detects	4.986	Kurtosis Detects	28.72
Mean of Logged Detects	0.188	SD of Logged Detects	1.676

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.395	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.372	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.118	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	2.035	Standard Error of Mean	0.777
SD	9.947	95% KM (BCA) UCL	3.536
95% KM (t) UCL	3.319	95% KM (Percentile Bootstrap) UCL	3.542
95% KM (z) UCL	3.312	95% KM Bootstrap t UCL	4.844
90% KM Chebyshev UCL	4.365	95% KM Chebyshev UCL	5.42
97.5% KM Chebyshev UCL	6.885	99% KM Chebyshev UCL	9.763

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	4.172	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.837	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.219	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.127	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.408	k star (bias corrected MLE)	0.398
Theta hat (MLE)	14.75	Theta star (bias corrected MLE)	15.12
nu hat (MLE)	45.71	nu star (bias corrected)	44.59
MLE Mean (bias corrected)	6.021	MLE Sd (bias corrected)	9.542

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0418	nu hat (KM)	13.97
Approximate Chi Square Value (13.97, α)	6.554	Adjusted Chi Square Value (13.97, β)	6.509
95% Gamma Approximate KM-UCL (use when n>=50)	4.338	95% Gamma Adjusted KM-UCL (use when n<50)	4.368

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.026
Maximum	110	Median	0.01
SD	9.979	CV	4.926
k hat (MLE)	0.199	k star (bias corrected MLE)	0.199
Theta hat (MLE)	10.19	Theta star (bias corrected MLE)	10.16
nu hat (MLE)	66.42	nu star (bias corrected)	66.56
MLE Mean (bias corrected)	2.026	MLE Sd (bias corrected)	4.537
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (66.56, α)	48.79	Adjusted Chi Square Value (66.56, β)	48.66
95% Gamma Approximate UCL (use when n>=50)	2.764	95% Gamma Adjusted UCL (use when n<50)	2.771

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.0897	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.118	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.032	Mean in Log Scale	-3.167
SD in Original Scale	9.978	SD in Log Scale	2.884
95% t UCL (assumes normality of ROS data)	3.309	95% Percentile Bootstrap UCL	3.392
95% BCA Bootstrap UCL	4.066	95% Bootstrap t UCL	4.901
95% H-UCL (Log ROS)	7.009		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.558	95% H-UCL (KM -Log)	1.562
KM SD (logged)	2.2	95% Critical H Value (KM-Log)	3.427
KM Standard Error of Mean (logged)	0.174		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.069	Mean in Log Scale	-2.041
SD in Original Scale	9.97	SD in Log Scale	2.034
95% t UCL (Assumes normality)	3.345	95% H-Stat UCL	1.714

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 5.42

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benzo(a)pyrene

General Statistics

Total Number of Observations	167	Number of Distinct Observations	65
Number of Detects	51	Number of Non-Detects	116
Number of Distinct Detects	42	Number of Distinct Non-Detects	27
Minimum Detect	0.12	Minimum Non-Detect	0.017
Maximum Detect	98	Maximum Non-Detect	0.47
Variance Detects	212.7	Percent Non-Detects	69.46%
Mean Detects	5.471	SD Detects	14.58
Median Detects	1.2	CV Detects	2.666
Skewness Detects	5.445	Kurtosis Detects	33.58
Mean of Logged Detects	0.347	SD of Logged Detects	1.534

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.387	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.357	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.124	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.686	Standard Error of Mean	0.654
SD	8.365	95% KM (BCA) UCL	3.032
95% KM (t) UCL	2.768	95% KM (Percentile Bootstrap) UCL	2.822
95% KM (z) UCL	2.762	95% KM Bootstrap t UCL	4.339
90% KM Chebyshev UCL	3.648	95% KM Chebyshev UCL	4.536
97.5% KM Chebyshev UCL	5.769	99% KM Chebyshev UCL	8.191

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.181	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.821	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.132	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.474	k star (bias corrected MLE)	0.459
Theta hat (MLE)	11.55	Theta star (bias corrected MLE)	11.92
nu hat (MLE)	48.31	nu star (bias corrected)	46.8
MLE Mean (bias corrected)	5.471	MLE Sd (bias corrected)	8.077

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0406	nu hat (KM)	13.57
Approximate Chi Square Value (13.57, α)	6.281	Adjusted Chi Square Value (13.57, β)	6.238
95% Gamma Approximate KM-UCL (use when n>=50)	3.645	95% Gamma Adjusted KM-UCL (use when n<50)	3.67

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.678
Maximum	98	Median	0.01

SD	8.392	CV	5.002
k hat (MLE)	0.203	k star (bias corrected MLE)	0.204
Theta hat (MLE)	8.251	Theta star (bias corrected MLE)	8.238
nu hat (MLE)	67.91	nu star (bias corrected)	68.02
MLE Mean (bias corrected)	1.678	MLE Sd (bias corrected)	3.718
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (68.02, α)	50.04	Adjusted Chi Square Value (68.02, β)	49.9
95% Gamma Approximate UCL (use when n>=50)	2.281	95% Gamma Adjusted UCL (use when n<50)	2.287

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.0909	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.124	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.69	Mean in Log Scale	-3.022
SD in Original Scale	8.39	SD in Log Scale	2.721
95% t UCL (assumes normality of ROS data)	2.763	95% Percentile Bootstrap UCL	2.858
95% BCA Bootstrap UCL	3.555	95% Bootstrap t UCL	4.322
95% H-UCL (Log ROS)	4.656		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.677	95% H-UCL (KM -Log)	1.39
KM SD (logged)	2.2	95% Critical H Value (KM-Log)	3.428
KM Standard Error of Mean (logged)	0.174		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.721	Mean in Log Scale	-2.129
SD in Original Scale	8.384	SD in Log Scale	2.038
95% t UCL (Assumes normality)	2.794	95% H-Stat UCL	1.584

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 4.536

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	167	Number of Distinct Observations	75
Number of Detects	52	Number of Non-Detects	115
Number of Distinct Detects	44	Number of Distinct Non-Detects	33
Minimum Detect	0.11	Minimum Non-Detect	0.024
Maximum Detect	130	Maximum Non-Detect	7
Variance Detects	382.1	Percent Non-Detects	68.86%
Mean Detects	7.647	SD Detects	19.55
Median Detects	1.65	CV Detects	2.556
Skewness Detects	5.194	Kurtosis Detects	31.05
Mean of Logged Detects	0.657	SD of Logged Detects	1.611

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.409	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.35	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.123	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	2.405	Standard Error of Mean	0.888
SD	11.36	95% KM (BCA) UCL	4.074
95% KM (t) UCL	3.874	95% KM (Percentile Bootstrap) UCL	4
95% KM (z) UCL	3.865	95% KM Bootstrap t UCL	5.684
90% KM Chebyshev UCL	5.069	95% KM Chebyshev UCL	6.275
97.5% KM Chebyshev UCL	7.95	99% KM Chebyshev UCL	11.24

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.776	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.823	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.203	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.131	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.466	k star (bias corrected MLE)	0.452
Theta hat (MLE)	16.4	Theta star (bias corrected MLE)	16.91
nu hat (MLE)	48.49	nu star (bias corrected)	47.02
MLE Mean (bias corrected)	7.647	MLE Sd (bias corrected)	11.37

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0448	nu hat (KM)	14.96
Approximate Chi Square Value (14.96, α)	7.234	Adjusted Chi Square Value (14.96, β)	7.187
95% Gamma Approximate KM-UCL (use when n>=50)	4.973	95% Gamma Adjusted KM-UCL (use when n<50)	5.006

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.388
Maximum	130	Median	0.01
SD	11.4	CV	4.774
k hat (MLE)	0.193	k star (bias corrected MLE)	0.193
Theta hat (MLE)	12.38	Theta star (bias corrected MLE)	12.35
nu hat (MLE)	64.42	nu star (bias corrected)	64.6
MLE Mean (bias corrected)	2.388	MLE Sd (bias corrected)	5.43
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (64.60, α)	47.1	Adjusted Chi Square Value (64.60, β)	46.98
95% Gamma Approximate UCL (use when n>=50)	3.275	95% Gamma Adjusted UCL (use when n<50)	3.284

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.0748	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.123	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.404	Mean in Log Scale	-2.697
SD in Original Scale	11.4	SD in Log Scale	2.719
95% t UCL (assumes normality of ROS data)	3.863	95% Percentile Bootstrap UCL	4.002
95% BCA Bootstrap UCL	4.806	95% Bootstrap t UCL	5.791
95% H-UCL (Log ROS)	6.407		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.313	95% H-UCL (KM -Log)	2.076
KM SD (logged)	2.214	95% Critical H Value (KM-Log)	3.444
KM Standard Error of Mean (logged)	0.175		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.459	Mean in Log Scale	-1.782
SD in Original Scale	11.39	SD in Log Scale	2.039
95% t UCL (Assumes normality)	3.917	95% H-Stat UCL	2.25

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 6.275

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benzo(k)fluoranthene

General Statistics

Total Number of Observations	167	Number of Distinct Observations	64
Number of Detects	48	Number of Non-Detects	119
Number of Distinct Detects	40	Number of Distinct Non-Detects	29
Minimum Detect	0.065	Minimum Non-Detect	0.017
Maximum Detect	45	Maximum Non-Detect	0.73
Variance Detects	50.18	Percent Non-Detects	71.26%
Mean Detects	2.899	SD Detects	7.084
Median Detects	0.65	CV Detects	2.443
Skewness Detects	4.872	Kurtosis Detects	27.38
Mean of Logged Detects	-0.218	SD of Logged Detects	1.496

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.427	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.947	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.345	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.128	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.852	Standard Error of Mean	0.311
SD	3.977	95% KM (BCA) UCL	1.462
95% KM (t) UCL	1.367	95% KM (Percentile Bootstrap) UCL	1.378
95% KM (z) UCL	1.364	95% KM Bootstrap t UCL	2.088

90% KM Chebyshev UCL	1.786	95% KM Chebyshev UCL	2.208
97.5% KM Chebyshev UCL	2.795	99% KM Chebyshev UCL	3.947

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.973	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.815	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.224	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.135	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.496	k star (bias corrected MLE)	0.479
Theta hat (MLE)	5.845	Theta star (bias corrected MLE)	6.053
nu hat (MLE)	47.62	nu star (bias corrected)	45.98
MLE Mean (bias corrected)	2.899	MLE Sd (bias corrected)	4.189

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.046	nu hat (KM)	15.35
Approximate Chi Square Value (15.35, α)	7.505	Adjusted Chi Square Value (15.35, β)	7.457
95% Gamma Approximate KM-UCL (use when n>=50)	1.744	95% Gamma Adjusted KM-UCL (use when n<50)	1.755

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.84
Maximum	45	Median	0.01
SD	3.991	CV	4.749
k hat (MLE)	0.227	k star (bias corrected MLE)	0.227
Theta hat (MLE)	3.695	Theta star (bias corrected MLE)	3.696
nu hat (MLE)	75.97	nu star (bias corrected)	75.94
MLE Mean (bias corrected)	0.84	MLE Sd (bias corrected)	1.763
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (75.94, α)	56.87	Adjusted Chi Square Value (75.94, β)	56.73
95% Gamma Approximate UCL (use when n>=50)	1.122	95% Gamma Adjusted UCL (use when n<50)	1.125

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.947	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.105	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.128	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.847	Mean in Log Scale	-3.532
SD in Original Scale	3.99	SD in Log Scale	2.599
95% t UCL (assumes normality of ROS data)	1.357	95% Percentile Bootstrap UCL	1.399
95% BCA Bootstrap UCL	1.698	95% Bootstrap t UCL	2.043
95% H-UCL (Log ROS)	1.886		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.882	95% H-UCL (KM -Log)	0.566
KM SD (logged)	1.923	95% Critical H Value (KM-Log)	3.105

KM Standard Error of Mean (logged)	0.155

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.889	Mean in Log Scale	-2.311
SD in Original Scale	3.982	SD in Log Scale	1.792
95% t UCL (Assumes normality)	1.399	95% H-Stat UCL	0.745

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL 1.462

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Carbazole

General Statistics

Total Number of Observations	268	Number of Distinct Observations	50
Number of Detects	72	Number of Non-Detects	196
Number of Distinct Detects	30	Number of Distinct Non-Detects	22
Minimum Detect	0.045	Minimum Non-Detect	0.009
Maximum Detect	44	Maximum Non-Detect	0.27
Variance Detects	68.34	Percent Non-Detects	73.13%
Mean Detects	2.812	SD Detects	8.267
Median Detects	0.24	CV Detects	2.94
Skewness Detects	4.087	Kurtosis Detects	17.13
Mean of Logged Detects	-0.88	SD of Logged Detects	1.653

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.374	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.41	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.104	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.763	Standard Error of Mean	0.273
SD	4.433	95% KM (BCA) UCL	1.284
95% KM (t) UCL	1.213	95% KM (Percentile Bootstrap) UCL	1.24
95% KM (z) UCL	1.212	95% KM Bootstrap t UCL	1.573
90% KM Chebyshev UCL	1.581	95% KM Chebyshev UCL	1.952
97.5% KM Chebyshev UCL	2.466	99% KM Chebyshev UCL	3.476

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	9.454	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.853	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.318	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.113	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.351	k star (bias corrected MLE)	0.346
Theta hat (MLE)	8.009	Theta star (bias corrected MLE)	8.133
nu hat (MLE)	50.56	nu star (bias corrected)	49.79
MLE Mean (bias corrected)	2.812	MLE Sd (bias corrected)	4.782

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0296	nu hat (KM)	15.88
Approximate Chi Square Value (15.88, α)	7.879	Adjusted Chi Square Value (15.88, β)	7.849
95% Gamma Approximate KM-UCL (use when n>=50)	1.538	95% Gamma Adjusted KM-UCL (use when n<50)	1.544

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.763
Maximum	44	Median	0.01
SD	4.441	CV	5.822
k hat (MLE)	0.218	k star (bias corrected MLE)	0.218
Theta hat (MLE)	3.502	Theta star (bias corrected MLE)	3.501
nu hat (MLE)	116.7	nu star (bias corrected)	116.8
MLE Mean (bias corrected)	0.763	MLE Sd (bias corrected)	1.634
		Adjusted Level of Significance (β)	0.0491
Approximate Chi Square Value (116.77, α)	92.82	Adjusted Chi Square Value (116.77, β)	92.71
95% Gamma Approximate UCL (use when n>=50)	0.96	95% Gamma Adjusted UCL (use when n<50)	0.961

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.104	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.76	Mean in Log Scale	-4.909
SD in Original Scale	4.441	SD in Log Scale	3.12
95% t UCL (assumes normality of ROS data)	1.208	95% Percentile Bootstrap UCL	1.218
95% BCA Bootstrap UCL	1.43	95% Bootstrap t UCL	1.675
95% H-UCL (Log ROS)	2.236		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.774	Mean in Log Scale	-2.997
SD in Original Scale	4.439	SD in Log Scale	1.574
95% t UCL (Assumes normality)	1.221	95% H-Stat UCL	0.223

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1.952

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chrysene

General Statistics

Total Number of Observations	167	Number of Distinct Observations	73
Number of Detects	56	Number of Non-Detects	111
Number of Distinct Detects	49	Number of Distinct Non-Detects	26
Minimum Detect	0.064	Minimum Non-Detect	0.016
Maximum Detect	100	Maximum Non-Detect	3.1
Variance Detects	223	Percent Non-Detects	66.47%
Mean Detects	5.491	SD Detects	14.93
Median Detects	0.91	CV Detects	2.719
Skewness Detects	5.101	Kurtosis Detects	30.03
Mean of Logged Detects	0.197	SD of Logged Detects	1.621

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.395	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.378	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.118	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.857	Standard Error of Mean	0.699
SD	8.951	95% KM (BCA) UCL	3.159
95% KM (t) UCL	3.013	95% KM (Percentile Bootstrap) UCL	3.187
95% KM (z) UCL	3.007	95% KM Bootstrap t UCL	4.255
90% KM Chebyshev UCL	3.954	95% KM Chebyshev UCL	4.904
97.5% KM Chebyshev UCL	6.222	99% KM Chebyshev UCL	8.811

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.883	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.832	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.127	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.431	k star (bias corrected MLE)	0.42
Theta hat (MLE)	12.73	Theta star (bias corrected MLE)	13.07
nu hat (MLE)	48.33	nu star (bias corrected)	47.07
MLE Mean (bias corrected)	5.491	MLE Sd (bias corrected)	8.471

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0431	nu hat (KM)	14.38
Approximate Chi Square Value (14.38, α)	6.832	Adjusted Chi Square Value (14.38, β)	6.787
95% Gamma Approximate KM-UCL (use when n>=50)	3.909	95% Gamma Adjusted KM-UCL (use when n<50)	3.935

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.848
Maximum	100	Median	0.01

SD	8.979	CV	4.859
k hat (MLE)	0.203	k star (bias corrected MLE)	0.204
Theta hat (MLE)	9.087	Theta star (bias corrected MLE)	9.072
nu hat (MLE)	67.93	nu star (bias corrected)	68.04
MLE Mean (bias corrected)	1.848	MLE Sd (bias corrected)	4.095
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (68.04, α)	50.05	Adjusted Chi Square Value (68.04, β)	49.92
95% Gamma Approximate UCL (use when n>=50)	2.512	95% Gamma Adjusted UCL (use when n<50)	2.519

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.0914	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.118	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.857	Mean in Log Scale	-3.003
SD in Original Scale	8.978	SD in Log Scale	2.761
95% t UCL (assumes normality of ROS data)	3.006	95% Percentile Bootstrap UCL	3.066
95% BCA Bootstrap UCL	3.74	95% Bootstrap t UCL	4.488
95% H-UCL (Log ROS)	5.407		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.624	95% H-UCL (KM -Log)	1.636
KM SD (logged)	2.241	95% Critical H Value (KM-Log)	3.476
KM Standard Error of Mean (logged)	0.178		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.9	Mean in Log Scale	-2.054
SD in Original Scale	8.97	SD in Log Scale	2.063
95% t UCL (Assumes normality)	3.048	95% H-Stat UCL	1.816

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	4.904

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenzo(a,h)anthracene

General Statistics

Total Number of Observations	167	Number of Distinct Observations	61
Number of Detects	39	Number of Non-Detects	128
Number of Distinct Detects	34	Number of Distinct Non-Detects	31
Minimum Detect	0.033	Minimum Non-Detect	0.016
Maximum Detect	14	Maximum Non-Detect	0.61
Variance Detects	5.729	Percent Non-Detects	76.65%
Mean Detects	1.171	SD Detects	2.393
Median Detects	0.46	CV Detects	2.044
Skewness Detects	4.434	Kurtosis Detects	22.53
Mean of Logged Detects	-0.785	SD of Logged Detects	1.313

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.47	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.939	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.349	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.142	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.294	Standard Error of Mean	0.0973
SD	1.241	95% KM (BCA) UCL	0.479
95% KM (t) UCL	0.455	95% KM (Percentile Bootstrap) UCL	0.475
95% KM (z) UCL	0.454	95% KM Bootstrap t UCL	0.668
90% KM Chebyshev UCL	0.586	95% KM Chebyshev UCL	0.718
97.5% KM Chebyshev UCL	0.901	99% KM Chebyshev UCL	1.262

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.803	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.799	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.203	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.148	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.648	k star (bias corrected MLE)	0.615
Theta hat (MLE)	1.808	Theta star (bias corrected MLE)	1.904
nu hat (MLE)	50.53	nu star (bias corrected)	47.97
MLE Mean (bias corrected)	1.171	MLE Sd (bias corrected)	1.493

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.056	nu hat (KM)	18.7
Approximate Chi Square Value (18.70, α)	9.899	Adjusted Chi Square Value (18.70, β)	9.843
95% Gamma Approximate KM-UCL (use when n>=50)	0.555	95% Gamma Adjusted KM-UCL (use when n<50)	0.558

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.281
Maximum	14	Median	0.01
SD	1.247	CV	4.434
k hat (MLE)	0.285	k star (bias corrected MLE)	0.283
Theta hat (MLE)	0.988	Theta star (bias corrected MLE)	0.992
nu hat (MLE)	95.04	nu star (bias corrected)	94.67
MLE Mean (bias corrected)	0.281	MLE Sd (bias corrected)	0.528
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (94.67, α)	73.23	Adjusted Chi Square Value (94.67, β)	73.06
95% Gamma Approximate UCL (use when n>=50)	0.363	95% Gamma Adjusted UCL (use when n<50)	0.364

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.939	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0955	**Lilliefors GOF Test**	

5% Lilliefors Critical Value	0.142	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.285	Mean in Log Scale	-4.022
SD in Original Scale	1.246	SD in Log Scale	2.283
95% t UCL (assumes normality of ROS data)	0.445	95% Percentile Bootstrap UCL	0.466
95% BCA Bootstrap UCL	0.535	95% Bootstrap t UCL	0.652
95% H-UCL (Log ROS)	0.453		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.193	95% H-UCL (KM -Log)	0.186
KM SD (logged)	1.544	95% Critical H Value (KM-Log)	2.687
KM Standard Error of Mean (logged)	0.144		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.33	Mean in Log Scale	-2.654
SD in Original Scale	1.239	SD in Log Scale	1.514
95% t UCL (Assumes normality)	0.488	95% H-Stat UCL	0.303

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	0.479

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenzofuran

General Statistics

Total Number of Observations	167	Number of Distinct Observations	61
Number of Detects	31	Number of Non-Detects	136
Number of Distinct Detects	30	Number of Distinct Non-Detects	34
Minimum Detect	0.045	Minimum Non-Detect	0.012
Maximum Detect	99	Maximum Non-Detect	0.47
Variance Detects	315.8	Percent Non-Detects	81.44%
Mean Detects	4.631	SD Detects	17.77
Median Detects	0.36	CV Detects	3.838
Skewness Detects	5.33	Kurtosis Detects	29.06
Mean of Logged Detects	-0.59	SD of Logged Detects	1.711

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.271	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.929	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.413	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.159	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.878	Standard Error of Mean	0.609
SD	7.743	95% KM (BCA) UCL	2.179
95% KM (t) UCL	1.885	95% KM (Percentile Bootstrap) UCL	2.062
95% KM (z) UCL	1.88	95% KM Bootstrap t UCL	8.821
90% KM Chebyshev UCL	2.705	95% KM Chebyshev UCL	3.533
97.5% KM Chebyshev UCL	4.681	99% KM Chebyshev UCL	6.938

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.829	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.85	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.262	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.171	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.321	k star (bias corrected MLE)	0.312
Theta hat (MLE)	14.41	Theta star (bias corrected MLE)	14.86
nu hat (MLE)	19.92	nu star (bias corrected)	19.33
MLE Mean (bias corrected)	4.631	MLE Sd (bias corrected)	8.295

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0129	nu hat (KM)	4.293
Approximate Chi Square Value (4.29, α)	0.841	Adjusted Chi Square Value (4.29, β)	0.828
95% Gamma Approximate KM-UCL (use when n>=50)	4.482	95% Gamma Adjusted KM-UCL (use when n<50)	4.551

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.868
Maximum	99	Median	0.01
SD	7.767	CV	8.95
k hat (MLE)	0.198	k star (bias corrected MLE)	0.199
Theta hat (MLE)	4.378	Theta star (bias corrected MLE)	4.369
nu hat (MLE)	66.2	nu star (bias corrected)	66.35
MLE Mean (bias corrected)	0.868	MLE Sd (bias corrected)	1.947
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (66.35, α)	48.6	Adjusted Chi Square Value (66.35, β)	48.47
95% Gamma Approximate UCL (use when n>=50)	1.185	95% Gamma Adjusted UCL (use when n<50)	1.188

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.929	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.142	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.159	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.864	Mean in Log Scale	-5.522
SD in Original Scale	7.767	SD in Log Scale	3.076
95% t UCL (assumes normality of ROS data)	1.859	95% Percentile Bootstrap UCL	2.016
95% BCA Bootstrap UCL	3.12	95% Bootstrap t UCL	8.423
95% H-UCL (Log ROS)	1.329		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.515	95% H-UCL (KM -Log)	0.174
KM SD (logged)	1.673	95% Critical H Value (KM-Log)	2.826
KM Standard Error of Mean (logged)	0.182		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.921	Mean in Log Scale	-2.569
SD in Original Scale	7.761	SD in Log Scale	1.435
95% t UCL (Assumes normality)	1.915	95% H-Stat UCL	0.286

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 3.533

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	167	Number of Distinct Observations	65
Number of Detects	53	Number of Non-Detects	114
Number of Distinct Detects	44	Number of Distinct Non-Detects	26
Minimum Detect	0.064	Minimum Non-Detect	0.017
Maximum Detect	40	Maximum Non-Detect	0.47
Variance Detects	35.24	Percent Non-Detects	68.26%
Mean Detects	2.433	SD Detects	5.937
Median Detects	0.66	CV Detects	2.44
Skewness Detects	5.265	Kurtosis Detects	31.85
Mean of Logged Detects	-0.332	SD of Logged Detects	1.487

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.417	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.345	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.122	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.792	Standard Error of Mean	0.273
SD	3.497	95% KM (BCA) UCL	1.38
95% KM (t) UCL	1.244	95% KM (Percentile Bootstrap) UCL	1.287
95% KM (z) UCL	1.241	95% KM Bootstrap t UCL	1.82
90% KM Chebyshev UCL	1.611	95% KM Chebyshev UCL	1.983
97.5% KM Chebyshev UCL	2.498	99% KM Chebyshev UCL	3.51

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.562	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.813	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.158	**Kolmogrov-Smirnoff GOF**	

5% K-S Critical Value	0.129	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.517	k star (bias corrected MLE)	0.501
Theta hat (MLE)	4.704	Theta star (bias corrected MLE)	4.861
nu hat (MLE)	54.84	nu star (bias corrected)	53.07
MLE Mean (bias corrected)	2.433	MLE Sd (bias corrected)	3.439

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0513	nu hat (KM)	17.12
Approximate Chi Square Value (17.12, α)	8.76	Adjusted Chi Square Value (17.12, β)	8.707
95% Gamma Approximate KM-UCL (use when n>=50)	1.548	95% Gamma Adjusted KM-UCL (use when n<50)	1.557

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.779
Maximum	40	Median	0.01
SD	3.51	CV	4.505
k hat (MLE)	0.239	k star (bias corrected MLE)	0.238
Theta hat (MLE)	3.266	Theta star (bias corrected MLE)	3.27
nu hat (MLE)	79.69	nu star (bias corrected)	79.59
MLE Mean (bias corrected)	0.779	MLE Sd (bias corrected)	1.596
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (79.59, α)	60.04	Adjusted Chi Square Value (79.59, β)	59.89
95% Gamma Approximate UCL (use when n>=50)	1.033	95% Gamma Adjusted UCL (use when n<50)	1.035

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.0892	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.122	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.787	Mean in Log Scale	-3.306
SD in Original Scale	3.508	SD in Log Scale	2.506
95% t UCL (assumes normality of ROS data)	1.236	95% Percentile Bootstrap UCL	1.294
95% BCA Bootstrap UCL	1.521	95% Bootstrap t UCL	1.78
95% H-UCL (Log ROS)	1.774		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.787	95% H-UCL (KM -Log)	0.631
KM SD (logged)	1.929	95% Critical H Value (KM-Log)	3.113
KM Standard Error of Mean (logged)	0.156		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.825	Mean in Log Scale	-2.258
SD in Original Scale	3.501	SD in Log Scale	1.777
95% t UCL (Assumes normality)	1.273	95% H-Stat UCL	0.761

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL 1.38

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Naphthalene

General Statistics

Total Number of Observations	167	Number of Distinct Observations	75
Number of Detects	69	Number of Non-Detects	98
Number of Distinct Detects	54	Number of Distinct Non-Detects	25
Minimum Detect	0.046	Minimum Non-Detect	0.017
Maximum Detect	1700	Maximum Non-Detect	0.47
Variance Detects	44895	Percent Non-Detects	58.68%
Mean Detects	34.2	SD Detects	211.9
Median Detects	0.57	CV Detects	6.195
Skewness Detects	7.506	Kurtosis Detects	58.57
Mean of Logged Detects	-0.3	SD of Logged Detects	2

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.174	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.484	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.107	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	14.15	Standard Error of Mean	10.62
SD	136.2	95% KM (BCA) UCL	34.48
95% KM (t) UCL	31.72	95% KM (Percentile Bootstrap) UCL	34.32
95% KM (z) UCL	31.62	95% KM Bootstrap t UCL	532.6
90% KM Chebyshev UCL	46.01	95% KM Chebyshev UCL	60.45
97.5% KM Chebyshev UCL	80.48	99% KM Chebyshev UCL	119.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	13.34	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.922	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.351	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.119	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.193	k star (bias corrected MLE)	0.194
Theta hat (MLE)	177.1	Theta star (bias corrected MLE)	176
nu hat (MLE)	26.65	nu star (bias corrected)	26.82
MLE Mean (bias corrected)	34.2	MLE Sd (bias corrected)	77.59

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0108	nu hat (KM)	3.603
Approximate Chi Square Value (3.60, α)	0.572	Adjusted Chi Square Value (3.60, β)	0.562
95% Gamma Approximate KM-UCL (use when n>=50)	89.22	95% Gamma Adjusted KM-UCL (use when n<50)	90.74

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	14.14
Maximum	1700	Median	0.01
SD	136.7	CV	9.666
k hat (MLE)	0.142	k star (bias corrected MLE)	0.143
Theta hat (MLE)	99.88	Theta star (bias corrected MLE)	98.87
nu hat (MLE)	47.28	nu star (bias corrected)	47.76
MLE Mean (bias corrected)	14.14	MLE Sd (bias corrected)	37.39
		Adjusted Level of Significance (β)	0.0486
Approximate Chi Square Value (47.76, α)	32.9	Adjusted Chi Square Value (47.76, β)	32.79
95% Gamma Approximate UCL (use when n>=50)	20.52	95% Gamma Adjusted UCL (use when n<50)	20.59

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.09	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.107	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	14.14	Mean in Log Scale	-3.233
SD in Original Scale	136.7	SD in Log Scale	3.047
95% t UCL (assumes normality of ROS data)	31.63	95% Percentile Bootstrap UCL	34.5
95% BCA Bootstrap UCL	48.28	95% Bootstrap t UCL	529.2
95% H-UCL (Log ROS)	11.78		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.387	95% H-UCL (KM -Log)	2.002
KM SD (logged)	2.228	95% Critical H Value (KM-Log)	3.461
KM Standard Error of Mean (logged)	0.178		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	14.18	Mean in Log Scale	-1.974
SD in Original Scale	136.7	SD in Log Scale	2.073
95% t UCL (Assumes normality)	31.67	95% H-Stat UCL	2.019

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 80.48

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic, Total

General Statistics

Total Number of Observations	33	Number of Distinct Observations	24

		Number of Missing Observations	0
Minimum	1.5	Mean	8.133
Maximum	18	Median	6.2
SD	4.802	Std. Error of Mean	0.836
Coefficient of Variation	0.59	Skewness	0.723

Normal GOF Test

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.186	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9.549	95% Adjusted-CLT UCL (Chen-1995)	9.621
		95% Modified-t UCL (Johnson-1978)	9.567

Gamma GOF Test

A-D Test Statistic	0.474	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.141	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.154	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.934	k star (bias corrected MLE)	2.688
Theta hat (MLE)	2.772	Theta star (bias corrected MLE)	3.026
nu hat (MLE)	193.7	nu star (bias corrected)	177.4
MLE Mean (bias corrected)	8.133	MLE Sd (bias corrected)	4.961
		Approximate Chi Square Value (0.05)	147.6
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	146.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	9.776	95% Adjusted Gamma UCL (use when n<50)	9.869

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.108	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.405	Mean of logged Data	1.916
Maximum of Logged Data	2.89	SD of logged Data	0.63

Assuming Lognormal Distribution

95% H-UCL	10.41	90% Chebyshev (MVUE) UCL	11.13
95% Chebyshev (MVUE) UCL	12.44	97.5% Chebyshev (MVUE) UCL	14.26
99% Chebyshev (MVUE) UCL	17.84		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	9.508	95% Jackknife UCL	9.549
95% Standard Bootstrap UCL	9.443	95% Bootstrap-t UCL	9.554
95% Hall's Bootstrap UCL	9.583	95% Percentile Bootstrap UCL	9.536
95% BCA Bootstrap UCL	9.597		
90% Chebyshev(Mean, Sd) UCL	10.64	95% Chebyshev(Mean, Sd) UCL	11.78
97.5% Chebyshev(Mean, Sd) UCL	13.35	99% Chebyshev(Mean, Sd) UCL	16.45

Suggested UCL to Use

95% Adjusted Gamma UCL 9.869

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Chromium, Total

General Statistics

Total Number of Observations	33	Number of Distinct Observations	27
		Number of Missing Observations	0
Minimum	0.64	Mean	23.75
Maximum	120	Median	19
SD	24.9	Std. Error of Mean	4.334
Coefficient of Variation	1.048	Skewness	2.348

Normal GOF Test

Shapiro Wilk Test Statistic	0.759	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.239	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	31.09	95% Adjusted-CLT UCL (Chen-1995)	32.77
		95% Modified-t UCL (Johnson-1978)	31.39

Gamma GOF Test

A-D Test Statistic	0.289	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.773	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.116	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	0.157	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.133	k star (bias corrected MLE)	1.05
Theta hat (MLE)	20.96	Theta star (bias corrected MLE)	22.62
nu hat (MLE)	74.77	nu star (bias corrected)	69.31
MLE Mean (bias corrected)	23.75	MLE Sd (bias corrected)	23.18
		Approximate Chi Square Value (0.05)	51.15
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	50.34

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	32.18	95% Adjusted Gamma UCL (use when n<50)	32.7

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.135	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.154	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.446	Mean of logged Data	2.665
Maximum of Logged Data	4.787	SD of logged Data	1.132

Assuming Lognormal Distribution

95% H-UCL	45.92	90% Chebyshev (MVUE) UCL	45.05
95% Chebyshev (MVUE) UCL	53.47	97.5% Chebyshev (MVUE) UCL	65.15
99% Chebyshev (MVUE) UCL	88.1		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	30.88	95% Jackknife UCL	31.09
95% Standard Bootstrap UCL	30.82	95% Bootstrap-t UCL	34.66
95% Hall's Bootstrap UCL	37.85	95% Percentile Bootstrap UCL	31.37
95% BCA Bootstrap UCL	33.56		
90% Chebyshev(Mean, Sd) UCL	36.75	95% Chebyshev(Mean, Sd) UCL	42.64
97.5% Chebyshev(Mean, Sd) UCL	50.81	99% Chebyshev(Mean, Sd) UCL	66.87

Suggested UCL to Use

95% Adjusted Gamma UCL 32.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Lead

General Statistics

Total Number of Observations	33	Number of Distinct Observations	28
		Number of Missing Observations	0
Minimum	0.85	Mean	42.83
Maximum	740	Median	15
SD	127.2	Std. Error of Mean	22.15
Coefficient of Variation	2.97	Skewness	5.464

Normal GOF Test

Shapiro Wilk Test Statistic	0.302	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	80.35	95% Adjusted-CLT UCL (Chen-1995)	101.8
		95% Modified-t UCL (Johnson-1978)	83.86

Gamma GOF Test

A-D Test Statistic	2.411	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.805	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.161	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.559	k star (bias corrected MLE)	0.529
Theta hat (MLE)	76.58	Theta star (bias corrected MLE)	81.02
nu hat (MLE)	36.92	nu star (bias corrected)	34.89
MLE Mean (bias corrected)	42.83	MLE Sd (bias corrected)	58.91
		Approximate Chi Square Value (0.05)	22.38
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	21.86

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	66.78	95% Adjusted Gamma UCL (use when n<50)	68.36

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0975	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.163	Mean of logged Data	2.641
Maximum of Logged Data	6.607	SD of logged Data	1.3

Assuming Lognormal Distribution

95% H-UCL	62.51	90% Chebyshev (MVUE) UCL	57.31
95% Chebyshev (MVUE) UCL	69.11	97.5% Chebyshev (MVUE) UCL	85.5
99% Chebyshev (MVUE) UCL	117.7		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	79.26	95% Jackknife UCL	80.35
95% Standard Bootstrap UCL	78.27	95% Bootstrap-t UCL	240.9
95% Hall's Bootstrap UCL	204.1	95% Percentile Bootstrap UCL	86.19
95% BCA Bootstrap UCL	113.1		
90% Chebyshev(Mean, Sd) UCL	109.3	95% Chebyshev(Mean, Sd) UCL	139.4
97.5% Chebyshev(Mean, Sd) UCL	181.1	99% Chebyshev(Mean, Sd) UCL	263.2

Suggested UCL to Use

95% H-UCL	62.51

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.

H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Mineral Wool Pile ERP Coke, Birmingham, AL	UCL Statistics for Data Sets with Non-Detects PRO UCL v. 5.0.0 (2013)
User Selected Options	
Date/Time of Computation	4/10/2016 3:23:00 PM
From File	SMA 4, Mineral Wool Pile, ProUCL input file.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
Number of Detects	3	Number of Non-Detects	9
Number of Distinct Detects	3	Number of Distinct Non-Detects	7
Minimum Detect	0.058	Minimum Non-Detect	0.0067
Maximum Detect	0.19	Maximum Non-Detect	0.2
Variance Detects	0.0054	Percent Non-Detects	75%
Mean Detects	0.143	SD Detects	0.0735
Median Detects	0.18	CV Detects	0.515
Skewness Detects	-1.696	Kurtosis Detects	N/A
Mean of Logged Detects	-2.074	SD of Logged Detects	0.67

Warning: Data set has only 3 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.806	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.361	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.512	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0526	Standard Error of Mean	0.0289
SD	0.071	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.104	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.1	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.139	95% KM Chebyshev UCL	0.179
97.5% KM Chebyshev UCL	0.233	99% KM Chebyshev UCL	0.34

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	4.095	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0348	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	24.57	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.548	nu hat (KM)	13.16
		Adjusted Level of Significance (β)	0.029
Approximate Chi Square Value (13.16, α)	6.003	Adjusted Chi Square Value (13.16, β)	5.282
95% Gamma Approximate KM-UCL (use when n>=50)	0.115	95% Gamma Adjusted KM-UCL (use when n<50)	0.131

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.784	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level

Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.512	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0606	Mean in Log Scale	-3.117
SD in Original Scale	0.0598	SD in Log Scale	0.754
95% t UCL (assumes normality of ROS data)	0.0916	95% Percentile Bootstrap UCL	0.0879
95% BCA Bootstrap UCL	0.0986	95% Bootstrap t UCL	0.166
95% H-UCL (Log ROS)	0.104		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.961	95% H-UCL (KM -Log)	0.247
KM SD (logged)	1.407	95% Critical H Value (KM-Log)	3.704
KM Standard Error of Mean (logged)	0.602		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0756	Mean in Log Scale	-3.383
SD in Original Scale	0.0652	SD in Log Scale	1.683
95% t UCL (Assumes normality)	0.109	95% H-Stat UCL	1.229

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.104	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benzo(a)anthracene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
Number of Detects	3	Number of Non-Detects	9
Number of Distinct Detects	3	Number of Distinct Non-Detects	8
Minimum Detect	0.075	Minimum Non-Detect	0.0084
Maximum Detect	0.2	Maximum Non-Detect	0.2
Variance Detects	0.00483	Percent Non-Detects	75%
Mean Detects	0.155	SD Detects	0.0695
Median Detects	0.19	CV Detects	0.448
Skewness Detects	-1.692	Kurtosis Detects	N/A
Mean of Logged Detects	-1.953	SD of Logged Detects	0.552

Warning: Data set has only 3 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.81	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.359	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.512	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0519	Standard Error of Mean	0.0275
SD	0.0716	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.101	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.0971	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.134	95% KM Chebyshev UCL	0.172
97.5% KM Chebyshev UCL	0.223	99% KM Chebyshev UCL	0.325

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	5.77	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0269	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	34.62	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.525	nu hat (KM)	12.61
		Adjusted Level of Significance (β)	0.029
Approximate Chi Square Value (12.61, α)	5.632	Adjusted Chi Square Value (12.61, β)	4.939
95% Gamma Approximate KM-UCL (use when n>=50)	0.116	95% Gamma Adjusted KM-UCL (use when n<50)	0.133

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.789	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.369	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.512	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0691	Mean in Log Scale	-2.909
SD in Original Scale	0.0603	SD in Log Scale	0.647
95% t UCL (assumes normality of ROS data)	0.1	95% Percentile Bootstrap UCL	0.0978
95% BCA Bootstrap UCL	0.109	95% Bootstrap t UCL	0.182
95% H-UCL (Log ROS)	0.106		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.9	95% H-UCL (KM -Log)	0.188
KM SD (logged)	1.306	95% Critical H Value (KM-Log)	3.5
KM Standard Error of Mean (logged)	0.524		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0726	Mean in Log Scale	-3.47
SD in Original Scale	0.0706	SD in Log Scale	1.625
95% t UCL (Assumes normality)	0.109	95% H-Stat UCL	0.893

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.101	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
Number of Detects	3	Number of Non-Detects	9
Number of Distinct Detects	3	Number of Distinct Non-Detects	7
Minimum Detect	0.074	Minimum Non-Detect	0.011
Maximum Detect	0.22	Maximum Non-Detect	0.041
Variance Detects	0.00579	Percent Non-Detects	75%
Mean Detects	0.135	SD Detects	0.0761
Median Detects	0.11	CV Detects	0.565
Skewness Detects	1.306	Kurtosis Detects	N/A
Mean of Logged Detects	-2.108	SD of Logged Detects	0.551

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.294	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.512	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0419	Standard Error of Mean	0.0219
SD	0.0619	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.0812	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.0779	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.108	95% KM Chebyshev UCL	0.137
97.5% KM Chebyshev UCL	0.179	99% KM Chebyshev UCL	0.26

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	4.996	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.027	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	29.97	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.459	nu hat (KM)	11
		Adjusted Level of Significance (β)	0.029
Approximate Chi Square Value (11.00, α)	4.579	Adjusted Chi Square Value (11.00, β)	3.966
95% Gamma Approximate KM-UCL (use when n>=50)	0.101	95% Gamma Adjusted KM-UCL (use when n<50)	0.116

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.512	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0412	Mean in Log Scale	-4.035
SD in Original Scale	0.0651	SD in Log Scale	1.235
95% t UCL (assumes normality of ROS data)	0.0749	95% Percentile Bootstrap UCL	0.0715
95% BCA Bootstrap UCL	0.0846	95% Bootstrap t UCL	0.132
95% H-UCL (Log ROS)	0.132		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.909	95% H-UCL (KM -Log)	0.0934
KM SD (logged)	1.064	95% Critical H Value (KM-Log)	3.032
KM Standard Error of Mean (logged)	0.376		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0435	Mean in Log Scale	-3.897
SD in Original Scale	0.0641	SD in Log Scale	1.229
95% t UCL (Assumes normality)	0.0768	95% H-Stat UCL	0.15

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0812	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chrysene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
Number of Detects	4	Number of Non-Detects	8
Number of Distinct Detects	4	Number of Distinct Non-Detects	6
Minimum Detect	0.0092	Minimum Non-Detect	0.0084
Maximum Detect	0.23	Maximum Non-Detect	0.043
Variance Detects	0.0093	Percent Non-Detects	66.67%
Mean Detects	0.119	SD Detects	0.0964
Median Detects	0.118	CV Detects	0.812
Skewness Detects	0.0372	Kurtosis Detects	-1.811
Mean of Logged Detects	-2.642	SD of Logged Detects	1.44

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.985	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.443	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0453	Standard Error of Mean	0.0236
SD	0.0709	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.0878	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.0842	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.116	95% KM Chebyshev UCL	0.148
97.5% KM Chebyshev UCL	0.193	99% KM Chebyshev UCL	0.28

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.305	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.666	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.24	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.402	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.114	k star (bias corrected MLE)	0.445
Theta hat (MLE)	0.107	Theta star (bias corrected MLE)	0.267
nu hat (MLE)	8.915	nu star (bias corrected)	3.562
MLE Mean (bias corrected)	0.119	MLE Sd (bias corrected)	0.178

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.409	nu hat (KM)	9.817
Approximate Chi Square Value (9.82, α)	3.828	Adjusted Chi Square Value (9.82, β)	3.277
95% Gamma Approximate KM-UCL (use when n>=50)	0.116	95% Gamma Adjusted KM-UCL (use when n<50)	0.136

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0092	Mean	0.0463
Maximum	0.23	Median	0.01
SD	0.0735	CV	1.589
k hat (MLE)	0.69	k star (bias corrected MLE)	0.573
Theta hat (MLE)	0.067	Theta star (bias corrected MLE)	0.0807
nu hat (MLE)	16.56	nu star (bias corrected)	13.76
MLE Mean (bias corrected)	0.0463	MLE Sd (bias corrected)	0.0611
		Adjusted Level of Significance (β)	0.029
Approximate Chi Square Value (13.76, α)	6.404	Adjusted Chi Square Value (13.76, β)	5.656
95% Gamma Approximate UCL (use when n>=50)	0.0994	95% Gamma Adjusted UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.268	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.443	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.041	Mean in Log Scale	-5.171
SD in Original Scale	0.0764	SD in Log Scale	2.118
95% t UCL (assumes normality of ROS data)	0.0807	95% Percentile Bootstrap UCL	0.0789
95% BCA Bootstrap UCL	0.0922	95% Bootstrap t UCL	0.157
95% H-UCL (Log ROS)	1.496		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-4.052	95% H-UCL (KM -Log)	0.128
KM SD (logged)	1.23	95% Critical H Value (KM-Log)	3.35
KM Standard Error of Mean (logged)	0.41		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0492	Mean in Log Scale	-3.859
SD in Original Scale	0.0723	SD in Log Scale	1.33

95% t UCL (Assumes normality)	0.0866	95% H-Stat UCL	0.212

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0878	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
Number of Detects	1	Number of Non-Detects	11
Number of Distinct Detects	1	Number of Distinct Non-Detects	9

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
s suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BT

The data set for variable Dibenz(a,h)anthracene was not processed!

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
Number of Detects	2	Number of Non-Detects	10
Number of Distinct Detects	2	Number of Distinct Non-Detects	9
Minimum Detect	0.058	Minimum Non-Detect	0.0069
Maximum Detect	0.08	Maximum Non-Detect	0.046
Variance Detects	2.4200E-4	Percent Non-Detects	83.33%
Mean Detects	0.069	SD Detects	0.0156
Median Detects	0.069	CV Detects	0.225
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-2.687	SD of Logged Detects	0.227

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0173	Standard Error of Mean	0.00962
SD	0.0236	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.0345	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.0331	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.0461	95% KM Chebyshev UCL	0.0592
97.5% KM Chebyshev UCL	0.0774	99% KM Chebyshev UCL	0.113

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	39.01	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.00177	Theta star (bias corrected MLE)	N/A

nu hat (MLE)	156	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.535	nu hat (KM)	12.85
		Adjusted Level of Significance (β)	0.029
Approximate Chi Square Value (12.85, α)	5.792	Adjusted Chi Square Value (12.85, β)	5.086
95% Gamma Approximate KM-UCL (use when n>=50)	0.0383	95% Gamma Adjusted KM-UCL (use when n<50)	0.0436

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0257	Mean in Log Scale	-3.852
SD in Original Scale	0.0209	SD in Log Scale	0.565
95% t UCL (assumes normality of ROS data)	0.0365	95% Percentile Bootstrap UCL	0.0358
95% BCA Bootstrap UCL	0.0392	95% Bootstrap t UCL	0.105
95% H-UCL (Log ROS)	0.0364		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0221	Mean in Log Scale	-4.366
SD in Original Scale	0.024	SD in Log Scale	1.139
95% t UCL (Assumes normality)	0.0345	95% H-Stat UCL	0.0723

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0345	95% KM (% Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Carbazole

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
Number of Detects	1	Number of Non-Detects	11
Number of Distinct Detects	1	Number of Distinct Non-Detects	9

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
s suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BT

The data set for variable Carbazole was not processed!

Arsenic

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.11	Mean	1.723
Maximum	4.2	Median	1.95
SD	1.34	Std. Error of Mean	0.387
Coefficient of Variation	0.778	Skewness	0.382

Normal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.142	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.256	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.418	95% Adjusted-CLT UCL (Chen-1995)	2.405
		95% Modified-t UCL (Johnson-1978)	2.425

Gamma GOF Test

A-D Test Statistic	0.584	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.22	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	0.252	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.117	k star (bias corrected MLE)	0.893
Theta hat (MLE)	1.543	Theta star (bias corrected MLE)	1.93
nu hat (MLE)	26.8	nu star (bias corrected)	21.43
MLE Mean (bias corrected)	1.723	MLE Sd (bias corrected)	1.824
		Approximate Chi Square Value (0.05)	11.91
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	10.85

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3.1	95% Adjusted Gamma UCL (use when n<50)	3.406

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.854	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.235	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.256	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.207	Mean of logged Data	0.0338
Maximum of Logged Data	1.435	SD of logged Data	1.272

Assuming Lognormal Distribution

95% H-UCL	8.662	90% Chebyshev (MVUE) UCL	4.597
95% Chebyshev (MVUE) UCL	5.732	97.5% Chebyshev (MVUE) UCL	7.307
99% Chebyshev (MVUE) UCL	10.4		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.36	95% Jackknife UCL	2.418
95% Standard Bootstrap UCL	2.342	95% Bootstrap-t UCL	2.445
95% Hall's Bootstrap UCL	2.407	95% Percentile Bootstrap UCL	2.333
95% BCA Bootstrap UCL	2.393		
90% Chebyshev(Mean, Sd) UCL	2.884	95% Chebyshev(Mean, Sd) UCL	3.409
97.5% Chebyshev(Mean, Sd) UCL	4.139	99% Chebyshev(Mean, Sd) UCL	5.572

Suggested UCL to Use

95% Student's-t UCL	2.418

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Chromium

General Statistics

Total Number of Observations	12	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	25	Mean	31.08
Maximum	47	Median	29
SD	6.694	Std. Error of Mean	1.932
Coefficient of Variation	0.215	Skewness	1.583

Normal GOF Test

Shapiro Wilk Test Statistic	0.809	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.256	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	34.55	95% Adjusted-CLT UCL (Chen-1995)	35.21
		95% Modified-t UCL (Johnson-1978)	34.7

Gamma GOF Test

A-D Test Statistic	0.782	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	27.17	k star (bias corrected MLE)	20.43
Theta hat (MLE)	1.144	Theta star (bias corrected MLE)	1.521
nu hat (MLE)	652.1	nu star (bias corrected)	490.4
MLE Mean (bias corrected)	31.08	MLE Sd (bias corrected)	6.876
		Approximate Chi Square Value (0.05)	440.1
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	432.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	34.64	95% Adjusted Gamma UCL (use when n<50)	35.22

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.858	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.201	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.256	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.219	Mean of logged Data	3.418
Maximum of Logged Data	3.85	SD of logged Data	0.194

Assuming Lognormal Distribution

95% H-UCL	34.63	90% Chebyshev (MVUE) UCL	36.29
95% Chebyshev (MVUE) UCL	38.67	97.5% Chebyshev (MVUE) UCL	41.97
99% Chebyshev (MVUE) UCL	48.45		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	34.26	95% Jackknife UCL	34.55
95% Standard Bootstrap UCL	34.18	95% Bootstrap-t UCL	37.29
95% Hall's Bootstrap UCL	51.13	95% Percentile Bootstrap UCL	34.42
95% BCA Bootstrap UCL	35.42		
90% Chebyshev(Mean, Sd) UCL	36.88	95% Chebyshev(Mean, Sd) UCL	39.51
97.5% Chebyshev(Mean, Sd) UCL	43.15	99% Chebyshev(Mean, Sd) UCL	50.31

Suggested UCL to Use

95% Student's-t UCL	34.55

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

SMA 4 On-site Groundwater ERP Coke, Birmingham, AL	UCL Statistics for Data Sets with Non-Detects PRO UCL v. 5.0.0 (2013)
User Selected Options	
Date/Time of Computation	5/25/2016 9:33:50 AM
From File	SMA 4, Groundwater, ProUCL input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinylchloride

General Statistics

Total Number of Observations	69	Number of Distinct Observations	44
Number of Detects	33	Number of Non-Detects	36
Number of Distinct Detects	32	Number of Distinct Non-Detects	13
Minimum Detect	0.13	Minimum Non-Detect	0.1
Maximum Detect	330	Maximum Non-Detect	1000
Variance Detects	7942	Percent Non-Detects	52.17%
Mean Detects	47.11	SD Detects	89.12
Median Detects	1.7	CV Detects	1.892
Skewness Detects	2.039	Kurtosis Detects	3.152
Mean of Logged Detects	1.346	SD of Logged Detects	2.532

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.599	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.338	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	25.04	Standard Error of Mean	8.676
SD	67.71	95% KM (BCA) UCL	39.54
95% KM (t) UCL	39.51	95% KM (Percentile Bootstrap) UCL	40.66
95% KM (z) UCL	39.31	95% KM Bootstrap t UCL	48.58
90% KM Chebyshev UCL	51.07	95% KM Chebyshev UCL	62.86
97.5% KM Chebyshev UCL	79.22	99% KM Chebyshev UCL	111.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.396	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.866	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.237	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.167	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.279	k star (bias corrected MLE)	0.273
Theta hat (MLE)	169.2	Theta star (bias corrected MLE)	172.3
nu hat (MLE)	18.38	nu star (bias corrected)	18.04
MLE Mean (bias corrected)	47.11	MLE Sd (bias corrected)	90.1

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.137	nu hat (KM)	18.88
Approximate Chi Square Value (18.88, α)	10.03	Adjusted Chi Square Value (18.88, β)	9.889
95% Gamma Approximate KM-UCL (use when n>=50)	47.14	95% Gamma Adjusted KM-UCL (use when n<50)	47.8

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	23.19
Maximum	330	Median	0.13
SD	65.52	CV	2.826
k hat (MLE)	0.162	k star (bias corrected MLE)	0.165
Theta hat (MLE)	143.1	Theta star (bias corrected MLE)	140.9
nu hat (MLE)	22.35	nu star (bias corrected)	22.71
MLE Mean (bias corrected)	23.19	MLE Sd (bias corrected)	57.15
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (22.71, α)	12.87	Adjusted Chi Square Value (22.71, β)	12.72
95% Gamma Approximate UCL (use when n>=50)	40.9	95% Gamma Adjusted UCL (use when n<50)	41.41

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.884	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	22.79	Mean in Log Scale	-0.702
SD in Original Scale	65.49	SD in Log Scale	3.04
95% t UCL (assumes normality of ROS data)	35.93	95% Percentile Bootstrap UCL	36.34
95% BCA Bootstrap UCL	40.66	95% Bootstrap t UCL	43.18
95% H-UCL (Log ROS)	196.9		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	49.93	Mean in Log Scale	0.927
SD in Original Scale	104.1	SD in Log Scale	2.885
95% t UCL (Assumes normality)	70.82	95% H-Stat UCL	539.8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	79.22

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Acetone

General Statistics

Total Number of Observations	69	Number of Distinct Observations	23
Number of Detects	10	Number of Non-Detects	59
Number of Distinct Detects	10	Number of Distinct Non-Detects	14
Minimum Detect	2.1	Minimum Non-Detect	1.9
Maximum Detect	13000	Maximum Non-Detect	19000
Variance Detects	16660718	Percent Non-Detects	85.51%
Mean Detects	1470	SD Detects	4082
Median Detects	7.45	CV Detects	2.776
Skewness Detects	3.08	Kurtosis Detects	9.584
Mean of Logged Detects	3.298	SD of Logged Detects	2.893

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.426	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.436	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.28	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	223.2	Standard Error of Mean	204.3
SD	1585	95% KM (BCA) UCL	612
95% KM (t) UCL	563.8	95% KM (Percentile Bootstrap) UCL	595.9
95% KM (z) UCL	559.2	95% KM Bootstrap t UCL	42850
90% KM Chebyshev UCL	836	95% KM Chebyshev UCL	1114
97.5% KM Chebyshev UCL	1499	99% KM Chebyshev UCL	2256

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.665	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.868	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.372	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.296	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.186	k star (bias corrected MLE)	0.197
Theta hat (MLE)	7894	Theta star (bias corrected MLE)	7462
nu hat (MLE)	3.725	nu star (bias corrected)	3.941
MLE Mean (bias corrected)	1470	MLE Sd (bias corrected)	3312

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0198	nu hat (KM)	2.735
Approximate Chi Square Value (2.74, α)	0.298	Adjusted Chi Square Value (2.74, β)	0.285
95% Gamma Approximate KM-UCL (use when n>=50)	2045	95% Gamma Adjusted KM-UCL (use when n<50)	2143

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	213.1
Maximum	13000	Median	0.01
SD	1574	CV	7.386
k hat (MLE)	0.0929	k star (bias corrected MLE)	0.0985
Theta hat (MLE)	2294	Theta star (bias corrected MLE)	2163
nu hat (MLE)	12.82	nu star (bias corrected)	13.6
MLE Mean (bias corrected)	213.1	MLE Sd (bias corrected)	678.9
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (13.60, α)	6.296	Adjusted Chi Square Value (13.60, β)	6.19
95% Gamma Approximate UCL (use when n>=50)	460.2	95% Gamma Adjusted UCL (use when n<50)	468.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.793	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.28	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	213.2	Mean in Log Scale	-3.906
SD in Original Scale	1574	SD in Log Scale	4.38
95% t UCL (assumes normality of ROS data)	529.1	95% Percentile Bootstrap UCL	589.8
95% BCA Bootstrap UCL	825	95% Bootstrap t UCL	50553

95% H-UCL (Log ROS)	5802

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	1.14	95% H-UCL (KM -Log)	13.62
KM SD (logged)	1.462	95% Critical H Value (KM-Log)	2.273
KM Standard Error of Mean (logged)	0.2		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	671.3	Mean in Log Scale	2.311
SD in Original Scale	2216	SD in Log Scale	2.789
95% t UCL (Assumes normality)	1116	95% H-Stat UCL	1497

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	1499

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Methylene chloride

General Statistics

Total Number of Observations	69	Number of Distinct Observations	24
Number of Detects	15	Number of Non-Detects	54
Number of Distinct Detects	14	Number of Distinct Non-Detects	12
Minimum Detect	0.32	Minimum Non-Detect	0.32
Maximum Detect	830	Maximum Non-Detect	3200
Variance Detects	54319	Percent Non-Detects	78.26%
Mean Detects	109.1	SD Detects	233.1
Median Detects	4	CV Detects	2.135
Skewness Detects	2.617	Kurtosis Detects	6.84
Mean of Logged Detects	1.827	SD of Logged Detects	2.833

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.552	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.374	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.229	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	26.35	Standard Error of Mean	15.55
SD	119.2	95% KM (BCA) UCL	55.41
95% KM (t) UCL	52.28	95% KM (Percentile Bootstrap) UCL	53.52
95% KM (z) UCL	51.92	95% KM Bootstrap t UCL	140.3
90% KM Chebyshev UCL	73	95% KM Chebyshev UCL	94.13
97.5% KM Chebyshev UCL	123.5	99% KM Chebyshev UCL	181.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.089	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.86	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.199	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.243	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.248	k star (bias corrected MLE)	0.243
Theta hat (MLE)	439.9	Theta star (bias corrected MLE)	449.3
nu hat (MLE)	7.444	nu star (bias corrected)	7.288
MLE Mean (bias corrected)	109.1	MLE Sd (bias corrected)	221.4

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0488	nu hat (KM)	6.739
Approximate Chi Square Value (6.74, α)	2.029	Adjusted Chi Square Value (6.74, β)	1.974
95% Gamma Approximate KM-UCL (use when n>=50)	87.53	95% Gamma Adjusted KM-UCL (use when n<50)	89.94

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	23.73
Maximum	830	Median	0.01
SD	115.1	CV	4.848
k hat (MLE)	0.124	k star (bias corrected MLE)	0.128
Theta hat (MLE)	191.6	Theta star (bias corrected MLE)	185.2
nu hat (MLE)	17.1	nu star (bias corrected)	17.69
MLE Mean (bias corrected)	23.73	MLE Sd (bias corrected)	66.3
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (17.69, α)	9.164	Adjusted Chi Square Value (17.69, β)	9.033
95% Gamma Approximate UCL (use when n>=50)	45.81	95% Gamma Adjusted UCL (use when n<50)	46.47

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.873	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.229	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	23.76	Mean in Log Scale	-4.841
SD in Original Scale	115.1	SD in Log Scale	4.815
95% t UCL (assumes normality of ROS data)	46.85	95% Percentile Bootstrap UCL	50.06
95% BCA Bootstrap UCL	58.51	95% Bootstrap t UCL	128.7
95% H-UCL (Log ROS)	32884		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.382	95% H-UCL (KM -Log)	7.046
KM SD (logged)	1.854	95% Critical H Value (KM-Log)	2.742
KM Standard Error of Mean (logged)	0.247		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	105.6	Mean in Log Scale	0.534
SD in Original Scale	299.8	SD in Log Scale	2.923
95% t UCL (Assumes normality)	165.8	95% H-Stat UCL	422.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	52.28	95% GROS Approximate Gamma UCL	45.81

95% Approximate Gamma KM-UCL	87.53

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

cis-1,2-Dichloroethene

General Statistics

Total Number of Observations	69	Number of Distinct Observations	37
Number of Detects	31	Number of Non-Detects	38
Number of Distinct Detects	26	Number of Distinct Non-Detects	13
Minimum Detect	0.15	Minimum Non-Detect	0.15
Maximum Detect	260	Maximum Non-Detect	1500
Variance Detects	4031	Percent Non-Detects	55.07%
Mean Detects	32.8	SD Detects	63.49
Median Detects	0.62	CV Detects	1.936
Skewness Detects	2.266	Kurtosis Detects	4.962
Mean of Logged Detects	0.963	SD of Logged Detects	2.523

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.596	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.929	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.354	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.159	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	16.67	Standard Error of Mean	6.078
SD	47.05	95% KM (BCA) UCL	27
95% KM (t) UCL	26.81	95% KM (Percentile Bootstrap) UCL	26.58
95% KM (z) UCL	26.67	95% KM Bootstrap t UCL	31.89
90% KM Chebyshev UCL	34.91	95% KM Chebyshev UCL	43.17
97.5% KM Chebyshev UCL	54.63	99% KM Chebyshev UCL	77.15

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.466	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.866	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.257	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.172	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.276	k star (bias corrected MLE)	0.271
Theta hat (MLE)	118.6	Theta star (bias corrected MLE)	120.9
nu hat (MLE)	17.14	nu star (bias corrected)	16.82
MLE Mean (bias corrected)	32.8	MLE Sd (bias corrected)	62.98

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.126	nu hat (KM)	17.33
Approximate Chi Square Value (17.33, α)	8.912	Adjusted Chi Square Value (17.33, β)	8.782
95% Gamma Approximate KM-UCL (use when n>=50)	32.43	95% Gamma Adjusted KM-UCL (use when n<50)	32.91

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detected data is small such as < 0.1
For such situations, GROS method tends to yield inflated values of UCLs and BTVs
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	15.16

Maximum	260	Median	0.01
SD	45.23	CV	2.984
k hat (MLE)	0.166	k star (bias corrected MLE)	0.168
Theta hat (MLE)	91.54	Theta star (bias corrected MLE)	90.2
nu hat (MLE)	22.85	nu star (bias corrected)	23.19
MLE Mean (bias corrected)	15.16	MLE Sd (bias corrected)	36.98
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (23.19, α)	13.24	Adjusted Chi Square Value (23.19, β)	13.08
95% Gamma Approximate UCL (use when n>=50)	26.56	95% Gamma Adjusted UCL (use when n<50)	26.89

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.861	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.929	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.232	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.159	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	14.89	Mean in Log Scale	-1.339
SD in Original Scale	45.21	SD in Log Scale	3.138
95% t UCL (assumes normality of ROS data)	23.97	95% Percentile Bootstrap UCL	24.23
95% BCA Bootstrap UCL	27.6	95% Bootstrap t UCL	29.56
95% H-UCL (Log ROS)	155		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	55.72	Mean in Log Scale	0.785
SD in Original Scale	135.4	SD in Log Scale	2.908
95% t UCL (Assumes normality)	82.91	95% H-Stat UCL	513.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	54.63

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benzene

General Statistics

Total Number of Observations	69	Number of Distinct Observations	44
Number of Detects	42	Number of Non-Detects	27
Number of Distinct Detects	40	Number of Distinct Non-Detects	5
Minimum Detect	0.27	Minimum Non-Detect	0.16
Maximum Detect	61000	Maximum Non-Detect	8
Variance Detects	3.930E+8	Percent Non-Detects	39.13%
Mean Detects	9597	SD Detects	19824
Median Detects	12.5	CV Detects	2.066
Skewness Detects	1.867	Kurtosis Detects	1.795
Mean of Logged Detects	4.274	SD of Logged Detects	3.979

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.523	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.395	**Lilliefors GOF Test**

5% Lilliefors Critical Value	0.137	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	5842	Standard Error of Mean	1947
SD	15983	95% KM (BCA) UCL	9396
95% KM (t) UCL	9090	95% KM (Percentile Bootstrap) UCL	9049
95% KM (z) UCL	9045	95% KM Bootstrap t UCL	10169
90% KM Chebyshev UCL	11684	95% KM Chebyshev UCL	14331
97.5% KM Chebyshev UCL	18004	99% KM Chebyshev UCL	25219

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.983	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.952	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.261	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.154	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.156	k star (bias corrected MLE)	0.161
Theta hat (MLE)	61490	Theta star (bias corrected MLE)	59683
nu hat (MLE)	13.11	nu star (bias corrected)	13.51
MLE Mean (bias corrected)	9597	MLE Sd (bias corrected)	23933

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.134	nu hat (KM)	18.44
Approximate Chi Square Value (18.44, α)	9.707	Adjusted Chi Square Value (18.44, β)	9.572
95% Gamma Approximate KM-UCL (use when n>=50)	11096	95% Gamma Adjusted KM-UCL (use when n<50)	11253

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5842
Maximum	61000	Median	2.4
SD	16100	CV	2.756
k hat (MLE)	0.103	k star (bias corrected MLE)	0.108
Theta hat (MLE)	56835	Theta star (bias corrected MLE)	54102
nu hat (MLE)	14.18	nu star (bias corrected)	14.9
MLE Mean (bias corrected)	5842	MLE Sd (bias corrected)	17778
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (14.90, α)	7.193	Adjusted Chi Square Value (14.90, β)	7.078
95% Gamma Approximate UCL (use when n>=50)	12102	95% Gamma Adjusted UCL (use when n<50)	12298

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.819	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.137	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5842	Mean in Log Scale	0.648
SD in Original Scale	16100	SD in Log Scale	5.787
95% t UCL (assumes normality of ROS data)	9074	95% Percentile Bootstrap UCL	9285
95% BCA Bootstrap UCL	9860	95% Bootstrap t UCL	10028
95% H-UCL (Log ROS)	4.226E+9		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	5842	Mean in Log Scale	1.853
SD in Original Scale	16100	SD in Log Scale	4.413
95% t UCL (Assumes normality)	9074	95% H-Stat UCL	2240675

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 18004

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,2-Dichloroethane

General Statistics

Total Number of Observations	69	Number of Distinct Observations	15
Number of Detects	1	Number of Non-Detects	68
Number of Distinct Detects	1	Number of Distinct Non-Detects	14

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, B

The data set for variable 1,2-Dichloroethane was not processed!

Trichloroethene

General Statistics

Total Number of Observations	69	Number of Distinct Observations	17
Number of Detects	3	Number of Non-Detects	66
Number of Distinct Detects	3	Number of Distinct Non-Detects	14
Minimum Detect	0.89	Minimum Non-Detect	0.16
Maximum Detect	20	Maximum Non-Detect	1600
Variance Detects	119.2	Percent Non-Detects	95.65%
Mean Detects	7.397	SD Detects	10.92
Median Detects	1.3	CV Detects	1.476
Skewness Detects	1.729	Kurtosis Detects	N/A
Mean of Logged Detects	1.047	SD of Logged Detects	1.698

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.766	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.378	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.512	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.548	Standard Error of Mean	0.416
SD	2.585	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.242	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.233	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.797	95% KM Chebyshev UCL	2.362
97.5% KM Chebyshev UCL	3.147	99% KM Chebyshev UCL	4.69

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.641	k star (bias corrected MLE)	N/A
Theta hat (MLE)	11.53	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.849	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.045	nu hat (KM)	6.203
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (6.20, α)	1.745	Adjusted Chi Square Value (6.20, β)	1.695
95% Gamma Approximate KM-UCL (use when n>=50)	1.949	95% Gamma Adjusted KM-UCL (use when n<50)	2.006

Gamma (KM) may not be used when k hat (KM) is < 0.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.345	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.512	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.33	Mean in Log Scale	-7.482
SD in Original Scale	2.41	SD in Log Scale	3.582
95% t UCL (assumes normality of ROS data)	0.814	95% Percentile Bootstrap UCL	0.902
95% BCA Bootstrap UCL	1.238	95% Bootstrap t UCL	7.297
95% H-UCL (Log ROS)	2.389		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-1.656	95% H-UCL (KM -Log)	0.303
KM SD (logged)	0.742	95% Critical H Value (KM-Log)	2.053
KM Standard Error of Mean (logged)	0.127		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	44.29	Mean in Log Scale	-0.37
SD in Original Scale	141.7	SD in Log Scale	2.815
95% t UCL (Assumes normality)	72.74	95% H-Stat UCL	113.1

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.242	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Toluene

General Statistics

Total Number of Observations	69	Number of Distinct Observations	33
Number of Detects	25	Number of Non-Detects	44

Number of Distinct Detects	24	Number of Distinct Non-Detects	10
Minimum Detect	0.18	Minimum Non-Detect	0.17
Maximum Detect	56000	Maximum Non-Detect	85
Variance Detects	3.914E+8	Percent Non-Detects	63.77%
Mean Detects	11841	SD Detects	19784
Median Detects	30	CV Detects	1.671
Skewness Detects	1.212	Kurtosis Detects	-0.325
Mean of Logged Detects	3.743	SD of Logged Detects	4.995

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.622	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.918	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.437	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.177	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	4290	Standard Error of Mean	1595
SD	12982	95% KM (BCA) UCL	7159
95% KM (t) UCL	6950	95% KM (Percentile Bootstrap) UCL	6987
95% KM (z) UCL	6914	95% KM Bootstrap t UCL	8067
90% KM Chebyshev UCL	9076	95% KM Chebyshev UCL	11243
97.5% KM Chebyshev UCL	14252	99% KM Chebyshev UCL	20162

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.246	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.957	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.237	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.198	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.138	k star (bias corrected MLE)	0.148
Theta hat (MLE)	85802	Theta star (bias corrected MLE)	79947
nu hat (MLE)	6.9	nu star (bias corrected)	7.406
MLE Mean (bias corrected)	11841	MLE Sd (bias corrected)	30768

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.109	nu hat (KM)	15.07
Approximate Chi Square Value (15.07, α)	7.312	Adjusted Chi Square Value (15.07, β)	7.196
95% Gamma Approximate KM-UCL (use when n>=50)	8844	95% Gamma Adjusted KM-UCL (use when n<50)	8986

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4290
Maximum	56000	Median	0.01
SD	13077	CV	3.048
k hat (MLE)	0.0835	k star (bias corrected MLE)	0.0895
Theta hat (MLE)	51397	Theta star (bias corrected MLE)	47933
nu hat (MLE)	11.52	nu star (bias corrected)	12.35
MLE Mean (bias corrected)	4290	MLE Sd (bias corrected)	14340
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (12.35, α)	5.46	Adjusted Chi Square Value (12.35, β)	5.362
95% Gamma Approximate UCL (use when n>=50)	9706	95% Gamma Adjusted UCL (use when n<50)	9884

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.834	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.918	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.186	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.177	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4290	Mean in Log Scale	-4.503
SD in Original Scale	13077	SD in Log Scale	7.883
95% t UCL (assumes normality of ROS data)	6916	95% Percentile Bootstrap UCL	7019
95% BCA Bootstrap UCL	7514	95% Bootstrap t UCL	8250
95% H-UCL (Log ROS)	5.531E+16		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	4292	Mean in Log Scale	0.624
SD in Original Scale	13077	SD in Log Scale	4.072
95% t UCL (Assumes normality)	6917	95% H-Stat UCL	95078

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	14252

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chlorobenzene

General Statistics

Total Number of Observations	69	Number of Distinct Observations	47
Number of Detects	52	Number of Non-Detects	17
Number of Distinct Detects	44	Number of Distinct Non-Detects	4
Minimum Detect	0.32	Minimum Non-Detect	0.17
Maximum Detect	160000	Maximum Non-Detect	17
Variance Detects	2.110E+9	Percent Non-Detects	24.64%
Mean Detects	18383	SD Detects	45932
Median Detects	8.3	CV Detects	2.499
Skewness Detects	2.269	Kurtosis Detects	3.415
Mean of Logged Detects	3.935	SD of Logged Detects	4.3

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.436	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.489	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.123	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	13854	Standard Error of Mean	4896
SD	40275	95% KM (BCA) UCL	22261
95% KM (t) UCL	22018	95% KM (Percentile Bootstrap) UCL	22427
95% KM (z) UCL	21907	95% KM Bootstrap t UCL	24510
90% KM Chebyshev UCL	28542	95% KM Chebyshev UCL	35195
97.5% KM Chebyshev UCL	44429	99% KM Chebyshev UCL	62567

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.595	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.977	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.308	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.14	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.133	k star (bias corrected MLE)	0.138
Theta hat (MLE)	138325	Theta star (bias corrected MLE)	133161
nu hat (MLE)	13.82	nu star (bias corrected)	14.36
MLE Mean (bias corrected)	18383	MLE Sd (bias corrected)	49476

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.118	nu hat (KM)	16.33
Approximate Chi Square Value (16.33, α)	8.194	Adjusted Chi Square Value (16.33, β)	8.071
95% Gamma Approximate KM-UCL (use when n>=50)	27606	95% Gamma Adjusted KM-UCL (use when n<50)	28027

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	13854
Maximum	160000	Median	2.2
SD	40570	CV	2.928
k hat (MLE)	0.105	k star (bias corrected MLE)	0.11
Theta hat (MLE)	132225	Theta star (bias corrected MLE)	126080
nu hat (MLE)	14.46	nu star (bias corrected)	15.16
MLE Mean (bias corrected)	13854	MLE Sd (bias corrected)	41793
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (15.16, α)	7.375	Adjusted Chi Square Value (15.16, β)	7.259
95% Gamma Approximate UCL (use when n>=50)	28483	95% Gamma Adjusted UCL (use when n<50)	28939

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.247	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.123	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	13854	Mean in Log Scale	1.842
SD in Original Scale	40570	SD in Log Scale	5.401
95% t UCL (assumes normality of ROS data)	21998	95% Percentile Bootstrap UCL	22571
95% BCA Bootstrap UCL	23810	95% Bootstrap t UCL	24814
95% H-UCL (Log ROS)	1.174E+9		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	13854	Mean in Log Scale	2.635
SD in Original Scale	40570	SD in Log Scale	4.431
95% t UCL (Assumes normality)	21999	95% H-Stat UCL	5420012

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 44429

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Ethylbenzene

General Statistics

Total Number of Observations	69	Number of Distinct Observations	17
Number of Detects	3	Number of Non-Detects	66
Number of Distinct Detects	3	Number of Distinct Non-Detects	14
Minimum Detect	0.22	Minimum Non-Detect	0.16
Maximum Detect	4.7	Maximum Non-Detect	1600
Variance Detects	6.646	Percent Non-Detects	95.65%
Mean Detects	1.723	SD Detects	2.578
Median Detects	0.25	CV Detects	1.496
Skewness Detects	1.732	Kurtosis Detects	N/A
Mean of Logged Detects	-0.451	SD of Logged Detects	1.732

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.755	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.383	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.512	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.255	Standard Error of Mean	0.11
SD	0.635	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.439	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.436	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.585	95% KM Chebyshev UCL	0.735
97.5% KM Chebyshev UCL	0.942	99% KM Chebyshev UCL	1.35

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.618	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2.788	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.709	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.161	nu hat (KM)	22.24
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (22.24, α)	12.52	Adjusted Chi Square Value (22.24, β)	12.36
95% Gamma Approximate KM-UCL (use when n>=50)	0.453	95% Gamma Adjusted KM-UCL (use when n<50)	0.459

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.781	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.372	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.512	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0772	Mean in Log Scale	-8.639
SD in Original Scale	0.566	SD in Log Scale	3.478

95% t UCL (assumes normality of ROS data)	0.191	95% Percentile Bootstrap UCL	0.212
95% BCA Bootstrap UCL	0.346	95% Bootstrap t UCL	1.632
95% H-UCL (Log ROS)	0.462		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-1.744	95% H-UCL (KM -Log)	0.218
KM SD (logged)	0.479	95% Critical H Value (KM-Log)	1.855
KM Standard Error of Mean (logged)	0.0835		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	44.17	Mean in Log Scale	-0.329
SD in Original Scale	141.7	SD in Log Scale	2.782
95% t UCL (Assumes normality)	72.62	95% H-Stat UCL	104.3

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.439	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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m,p-Xylenes

General Statistics

Total Number of Observations	69	Number of Distinct Observations	16
Number of Detects	3	Number of Non-Detects	66
Number of Distinct Detects	3	Number of Distinct Non-Detects	13
Minimum Detect	23	Minimum Non-Detect	0.34
Maximum Detect	690	Maximum Non-Detect	3400
Variance Detects	141523	Percent Non-Detects	95.65%
Mean Detects	256	SD Detects	376.2
Median Detects	55	CV Detects	1.47
Skewness Detects	1.718	Kurtosis Detects	N/A
Mean of Logged Detects	4.56	SD of Logged Detects	1.767

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.37	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.512	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	12.63	Standard Error of Mean	13.33
SD	86.36	95% KM (BCA) UCL	N/A
95% KM (t) UCL	34.86	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	34.55	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	52.62	95% KM Chebyshev UCL	70.73
97.5% KM Chebyshev UCL	95.88	99% KM Chebyshev UCL	145.3

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.624	k star (bias corrected MLE)	N/A
Theta hat (MLE)	410.6	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.741	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0214	nu hat (KM)	2.95
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (2.95, α)	0.358	Adjusted Chi Square Value (2.95, β)	0.342
95% Gamma Approximate KM-UCL (use when n>=50)	104.1	95% Gamma Adjusted KM-UCL (use when n<50)	109

Gamma (KM) may not be used when k hat (KM) is < 0.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.289	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.512	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	11.27	Mean in Log Scale	-5.687
SD in Original Scale	83.22	SD in Log Scale	4.197
95% t UCL (assumes normality of ROS data)	27.97	95% Percentile Bootstrap UCL	30.97
95% BCA Bootstrap UCL	51.28	95% Bootstrap t UCL	965.5
95% H-UCL (Log ROS)	343.8		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.795	95% H-UCL (KM -Log)	1.388
KM SD (logged)	1.266	95% Critical H Value (KM-Log)	2.093
KM Standard Error of Mean (logged)	0.2		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	100.4	Mean in Log Scale	0.437
SD in Original Scale	308.4	SD in Log Scale	2.853
95% t UCL (Assumes normality)	162.3	95% H-Stat UCL	292.5

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	34.86	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Isopropylbenzene

General Statistics

Total Number of Observations	69	Number of Distinct Observations	20
Number of Detects	6	Number of Non-Detects	63
Number of Distinct Detects	6	Number of Distinct Non-Detects	15

Minimum Detect	0.19	Minimum Non-Detect	0.19
Maximum Detect	73	Maximum Non-Detect	1900
Variance Detects	1105	Percent Non-Detects	91.3%
Mean Detects	42.6	SD Detects	33.24
Median Detects	58.5	CV Detects	0.78
Skewness Detects	-0.845	Kurtosis Detects	-1.857
Mean of Logged Detects	2.337	SD of Logged Detects	2.82

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.774	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.323	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.362	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	4.363	Standard Error of Mean	2.218
SD	15.81	95% KM (BCA) UCL	8.516
95% KM (t) UCL	8.062	95% KM (Percentile Bootstrap) UCL	8.053
95% KM (z) UCL	8.011	95% KM Bootstrap t UCL	7.797
90% KM Chebyshev UCL	11.02	95% KM Chebyshev UCL	14.03
97.5% KM Chebyshev UCL	18.21	99% KM Chebyshev UCL	26.43

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.101	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.743	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.419	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.35	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.456	k star (bias corrected MLE)	0.339
Theta hat (MLE)	93.49	Theta star (bias corrected MLE)	125.7
nu hat (MLE)	5.468	nu star (bias corrected)	4.067
MLE Mean (bias corrected)	42.6	MLE Sd (bias corrected)	73.17

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0761	nu hat (KM)	10.51
Approximate Chi Square Value (10.51, α)	4.261	Adjusted Chi Square Value (10.51, β)	4.176
95% Gamma Approximate KM-UCL (use when n>=50)	10.76	95% Gamma Adjusted KM-UCL (use when n<50)	10.98

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3.713
Maximum	73	Median	0.01
SD	15.08	CV	4.061
k hat (MLE)	0.145	k star (bias corrected MLE)	0.149
Theta hat (MLE)	25.55	Theta star (bias corrected MLE)	24.98
nu hat (MLE)	20.05	nu star (bias corrected)	20.51
MLE Mean (bias corrected)	3.713	MLE Sd (bias corrected)	9.631
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (20.51, α)	11.23	Adjusted Chi Square Value (20.51, β)	11.08
95% Gamma Approximate UCL (use when n>=50)	6.783	95% Gamma Adjusted UCL (use when n<50)	6.872

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.697	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.788	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.392	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.362	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.71	Mean in Log Scale	-8.958
SD in Original Scale	15.08	SD in Log Scale	5.542
95% t UCL (assumes normality of ROS data)	6.737	95% Percentile Bootstrap UCL	6.861
95% BCA Bootstrap UCL	8.049	95% Bootstrap t UCL	9.472
95% H-UCL (Log ROS)	59245		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	55.63	Mean in Log Scale	0.0209
SD in Original Scale	166.5	SD in Log Scale	2.96
95% t UCL (Assumes normality)	89.05	95% H-Stat UCL	293.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	8.062	95% KM (Percentile Bootstrap) UCL	8.053

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,4-Dioxane

General Statistics

Total Number of Observations	69	Number of Distinct Observations	19
Number of Detects	6	Number of Non-Detects	63
Number of Distinct Detects	4	Number of Distinct Non-Detects	15
Minimum Detect	1.7	Minimum Non-Detect	1.6
Maximum Detect	3.3	Maximum Non-Detect	570000
Variance Detects	0.379	Percent Non-Detects	91.3%
Mean Detects	2.05	SD Detects	0.616
Median Detects	1.8	CV Detects	0.3
Skewness Detects	2.392	Kurtosis Detects	5.78
Mean of Logged Detects	0.688	SD of Logged Detects	0.25

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.59	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.43	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.362	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.708	Standard Error of Mean	0.0736
SD	0.336	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.831	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.829	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.929	95% KM Chebyshev UCL	2.029
97.5% KM Chebyshev UCL	2.167	99% KM Chebyshev UCL	2.44

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.286	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.697	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.424	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.332	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	17.09	k star (bias corrected MLE)	8.655
Theta hat (MLE)	0.12	Theta star (bias corrected MLE)	0.237
nu hat (MLE)	205.1	nu star (bias corrected)	103.9
MLE Mean (bias corrected)	2.05	MLE Sd (bias corrected)	0.697

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	25.88	nu hat (KM)	3571
Approximate Chi Square Value (N/A, α)	3433	Adjusted Chi Square Value (N/A, β)	3430
95% Gamma Approximate KM-UCL (use when n>=50)	1.777	95% Gamma Adjusted KM-UCL (use when n<50)	1.778

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.677
Maximum	3.3	Median	0.478
SD	0.732	CV	1.082
k hat (MLE)	0.511	k star (bias corrected MLE)	0.499
Theta hat (MLE)	1.323	Theta star (bias corrected MLE)	1.357
nu hat (MLE)	70.57	nu star (bias corrected)	68.83
MLE Mean (bias corrected)	0.677	MLE Sd (bias corrected)	0.958
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (68.83, α)	50.74	Adjusted Chi Square Value (68.83, β)	50.41
95% Gamma Approximate UCL (use when n>=50)	0.918	95% Gamma Adjusted UCL (use when n<50)	0.924

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.623	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.407	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.362	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.083	Mean in Log Scale	-0.02
SD in Original Scale	0.521	SD in Log Scale	0.448
95% t UCL (assumes normality of ROS data)	1.188	95% Percentile Bootstrap UCL	1.19
95% BCA Bootstrap UCL	1.2	95% Bootstrap t UCL	1.206
95% H-UCL (Log ROS)	1.197		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	12185	Mean in Log Scale	3.661
SD in Original Scale	47536	SD in Log Scale	3.612
95% t UCL (Assumes normality)	21728	95% H-Stat UCL	189934

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.831	95% KM (% Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cyclohexane, Methyl-

General Statistics

Total Number of Observations	66	Number of Distinct Observations	18
Number of Detects	4	Number of Non-Detects	62
Number of Distinct Detects	4	Number of Distinct Non-Detects	15
Minimum Detect	0.36	Minimum Non-Detect	0.36
Maximum Detect	16	Maximum Non-Detect	3600
Variance Detects	48.34	Percent Non-Detects	93.94%
Mean Detects	7.915	SD Detects	6.953
Median Detects	7.65	CV Detects	0.878
Skewness Detects	0.157	Kurtosis Detects	-2.386
Mean of Logged Detects	1.402	SD of Logged Detects	1.708

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.443	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.985	Standard Error of Mean	0.443
SD	2.686	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.724	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.713	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	2.314	95% KM Chebyshev UCL	2.916
97.5% KM Chebyshev UCL	3.752	99% KM Chebyshev UCL	5.393

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.307	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.668	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.251	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.404	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.879	k star (bias corrected MLE)	0.386
Theta hat (MLE)	9.003	Theta star (bias corrected MLE)	20.48
nu hat (MLE)	7.033	nu star (bias corrected)	3.092
MLE Mean (bias corrected)	7.915	MLE Sd (bias corrected)	12.73

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.134	nu hat (KM)	17.73
Approximate Chi Square Value (17.73, α)	9.198	Adjusted Chi Square Value (17.73, β)	9.06
95% Gamma Approximate KM-UCL (use when n>=50)	1.898	95% Gamma Adjusted KM-UCL (use when n<50)	1.927

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detected data is small such as < 0.1
For such situations, GROS method tends to yield inflated values of UCLs and BTVs
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.489
Maximum	16	Median	0.01

SD	2.417	CV	4.943
k hat (MLE)	0.208	k star (bias corrected MLE)	0.208
Theta hat (MLE)	2.357	Theta star (bias corrected MLE)	2.349
nu hat (MLE)	27.39	nu star (bias corrected)	27.48
MLE Mean (bias corrected)	0.489	MLE Sd (bias corrected)	1.072
		Adjusted Level of Significance (β)	0.0464
Approximate Chi Square Value (27.48, α)	16.52	Adjusted Chi Square Value (27.48, β)	16.33
95% Gamma Approximate UCL (use when n>=50)	0.813	95% Gamma Adjusted UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.443	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.506	Mean in Log Scale	-5.31
SD in Original Scale	2.415	SD in Log Scale	3.016
95% t UCL (assumes normality of ROS data)	1.002	95% Percentile Bootstrap UCL	1.053
95% BCA Bootstrap UCL	1.325	95% Bootstrap t UCL	2.394
95% H-UCL (Log ROS)	1.972		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.818	95% H-UCL (KM -Log)	0.743
KM SD (logged)	0.794	95% Critical H Value (KM-Log)	2.092
KM Standard Error of Mean (logged)	0.133		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	92.19	Mean in Log Scale	0.487
SD in Original Scale	313.7	SD in Log Scale	2.757
95% t UCL (Assumes normality)	156.6	95% H-Stat UCL	235.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.724	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,2,4-Trichlorobenzene

General Statistics

Total Number of Observations	69	Number of Distinct Observations	17
Number of Detects	4	Number of Non-Detects	65
Number of Distinct Detects	4	Number of Distinct Non-Detects	14
Minimum Detect	0.64	Minimum Non-Detect	0.21
Maximum Detect	460	Maximum Non-Detect	2100
Variance Detects	67157	Percent Non-Detects	94.2%
Mean Detects	225.7	SD Detects	259.1
Median Detects	221	CV Detects	1.148
Skewness Detects	0.00513	Kurtosis Detects	-5.97
Mean of Logged Detects	3.128	SD of Logged Detects	3.476

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.752	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.306	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.443	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	14.09	Standard Error of Mean	11.13
SD	77.69	95% KM (BCA) UCL	N/A
95% KM (t) UCL	32.65	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	32.4	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	47.47	95% KM Chebyshev UCL	62.59
97.5% KM Chebyshev UCL	83.58	99% KM Chebyshev UCL	124.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.613	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.704	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.339	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.418	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.301	k star (bias corrected MLE)	0.242
Theta hat (MLE)	750.1	Theta star (bias corrected MLE)	933
nu hat (MLE)	2.407	nu star (bias corrected)	1.935
MLE Mean (bias corrected)	225.7	MLE Sd (bias corrected)	458.9

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0329	nu hat (KM)	4.542
Approximate Chi Square Value (4.54, α)	0.947	Adjusted Chi Square Value (4.54, β)	0.914
95% Gamma Approximate KM-UCL (use when n>=50)	67.61	95% Gamma Adjusted KM-UCL (use when n<50)	70.08

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	13.09
Maximum	460	Median	0.01
SD	76.06	CV	5.809
k hat (MLE)	0.118	k star (bias corrected MLE)	0.123
Theta hat (MLE)	110.9	Theta star (bias corrected MLE)	106.8
nu hat (MLE)	16.3	nu star (bias corrected)	16.92
MLE Mean (bias corrected)	13.09	MLE Sd (bias corrected)	37.39
		Adjusted Level of Significance (β)	0.0465
Approximate Chi Square Value (16.92, α)	8.617	Adjusted Chi Square Value (16.92, β)	8.491
95% Gamma Approximate UCL (use when n>=50)	25.71	95% Gamma Adjusted UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.809	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.303	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.443	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	13.08	Mean in Log Scale	-15.31

SD in Original Scale	76.06	SD in Log Scale	7.995
95% t UCL (assumes normality of ROS data)	28.35	95% Percentile Bootstrap UCL	31.94
95% BCA Bootstrap UCL	39.15	95% Bootstrap t UCL	3941
95% H-UCL (Log ROS)	3.501E+12		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-1.257	95% H-UCL (KM -Log)	1.019
KM SD (logged)	1.358	95% Critical H Value (KM-Log)	2.146
KM Standard Error of Mean (logged)	0.196		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	51.76	Mean in Log Scale	-0.378
SD in Original Scale	167.2	SD in Log Scale	2.697
95% t UCL (Assumes normality)	85.32	95% H-Stat UCL	73.18

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	32.65	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,3-Dichlorobenzene

General Statistics

Total Number of Observations	43	Number of Distinct Observations	16
Number of Detects	8	Number of Non-Detects	35
Number of Distinct Detects	7	Number of Distinct Non-Detects	9
Minimum Detect	0.2	Minimum Non-Detect	0.13
Maximum Detect	8.4	Maximum Non-Detect	65
Variance Detects	13.91	Percent Non-Detects	81.4%
Mean Detects	2.901	SD Detects	3.729
Median Detects	0.245	CV Detects	1.285
Skewness Detects	0.711	Kurtosis Detects	-1.954
Mean of Logged Detects	-0.197	SD of Logged Detects	1.816

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.698	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.313	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.708	Standard Error of Mean	0.323
SD	1.907	95% KM (BCA) UCL	1.305
95% KM (t) UCL	1.251	95% KM (Percentile Bootstrap) UCL	1.258
95% KM (z) UCL	1.239	95% KM Bootstrap t UCL	1.409
90% KM Chebyshev UCL	1.676	95% KM Chebyshev UCL	2.114
97.5% KM Chebyshev UCL	2.723	99% KM Chebyshev UCL	3.918

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.315	**Anderson-Darling GOF Test**	

5% A-D Critical Value	0.762	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.387	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.309	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.503	k star (bias corrected MLE)	0.398
Theta hat (MLE)	5.771	Theta star (bias corrected MLE)	7.298
nu hat (MLE)	8.044	nu star (bias corrected)	6.361
MLE Mean (bias corrected)	2.901	MLE Sd (bias corrected)	4.601

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.138	nu hat (KM)	11.86
Approximate Chi Square Value (11.86, α)	5.133	Adjusted Chi Square Value (11.86, β)	4.979
95% Gamma Approximate KM-UCL (use when n>=50)	1.636	95% Gamma Adjusted KM-UCL (use when n<50)	1.686

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.647
Maximum	8.4	Median	0.01
SD	1.91	CV	2.95
k hat (MLE)	0.242	k star (bias corrected MLE)	0.241
Theta hat (MLE)	2.673	Theta star (bias corrected MLE)	2.688
nu hat (MLE)	20.83	nu star (bias corrected)	20.71
MLE Mean (bias corrected)	0.647	MLE Sd (bias corrected)	1.319
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (20.71, α)	11.38	Adjusted Chi Square Value (20.71, β)	11.14
95% Gamma Approximate UCL (use when n>=50)	1.179	95% Gamma Adjusted UCL (use when n<50)	1.204

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.688	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.355	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.313	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.614	Mean in Log Scale	-2.893
SD in Original Scale	1.887	SD in Log Scale	2.092
95% t UCL (assumes normality of ROS data)	1.098	95% Percentile Bootstrap UCL	1.13
95% BCA Bootstrap UCL	1.311	95% Bootstrap t UCL	1.311
95% H-UCL (Log ROS)	1.684		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.819	Mean in Log Scale	-1.225
SD in Original Scale	5.293	SD in Log Scale	1.604
95% t UCL (Assumes normality)	3.177	95% H-Stat UCL	2.299

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	2.114

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,4-Dichlorobenzene

General Statistics

Total Number of Observations	43	Number of Distinct Observations	19
Number of Detects	13	Number of Non-Detects	30
Number of Distinct Detects	12	Number of Distinct Non-Detects	7
Minimum Detect	0.2	Minimum Non-Detect	0.16
Maximum Detect	560	Maximum Non-Detect	640
Variance Detects	43279	Percent Non-Detects	69.77%
Mean Detects	109.4	SD Detects	208
Median Detects	0.59	CV Detects	1.902
Skewness Detects	1.55	Kurtosis Detects	0.671
Mean of Logged Detects	1.074	SD of Logged Detects	3.056

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.573	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.461	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.246	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	34.01	Standard Error of Mean	19.61
SD	122.1	95% KM (BCA) UCL	70.52
95% KM (t) UCL	67	95% KM (Percentile Bootstrap) UCL	66.17
95% KM (z) UCL	66.27	95% KM Bootstrap t UCL	80.34
90% KM Chebyshev UCL	92.85	95% KM Chebyshev UCL	119.5
97.5% KM Chebyshev UCL	156.5	99% KM Chebyshev UCL	229.2

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.903	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.872	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.345	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.262	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.203	k star (bias corrected MLE)	0.207
Theta hat (MLE)	539.5	Theta star (bias corrected MLE)	527.8
nu hat (MLE)	5.272	nu star (bias corrected)	5.389
MLE Mean (bias corrected)	109.4	MLE Sd (bias corrected)	240.3

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0776	nu hat (KM)	6.67
Approximate Chi Square Value (6.67, α)	1.991	Adjusted Chi Square Value (6.67, β)	1.904
95% Gamma Approximate KM-UCL (use when n>=50)	113.9	95% Gamma Adjusted KM-UCL (use when n<50)	119.1

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detected data is small such as < 0.1
For such situations, GROS method tends to yield inflated values of UCLs and BTVs
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	33.08
Maximum	560	Median	0.01
SD	122.3	CV	3.696

k hat (MLE)	0.124	k star (bias corrected MLE)	0.131
Theta hat (MLE)	267.5	Theta star (bias corrected MLE)	253.4
nu hat (MLE)	10.63	nu star (bias corrected)	11.23
MLE Mean (bias corrected)	33.08	MLE Sd (bias corrected)	91.57
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (11.23, α)	4.721	Adjusted Chi Square Value (11.23, β)	4.575
95% Gamma Approximate UCL (use when n>=50)	78.66	95% Gamma Adjusted UCL (use when n<50)	81.17

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.777	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.246	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	33.11	Mean in Log Scale	-3.153
SD in Original Scale	122.3	SD in Log Scale	3.886
95% t UCL (assumes normality of ROS data)	64.47	95% Percentile Bootstrap UCL	66.1
95% BCA Bootstrap UCL	78.82	95% Bootstrap t UCL	2894
95% H-UCL (Log ROS)	4061		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.812	95% H-UCL (KM -Log)	13.07
KM SD (logged)	2.082	95% Critical H Value (KM-Log)	3.781
KM Standard Error of Mean (logged)	0.34		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	41.01	Mean in Log Scale	-0.61
SD in Original Scale	129.6	SD in Log Scale	2.46
95% t UCL (Assumes normality)	74.24	95% H-Stat UCL	58.03

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL 229.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

2-Chlorophenol

General Statistics

Total Number of Observations	43	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	38
Number of Distinct Detects	5	Number of Distinct Non-Detects	2
Minimum Detect	1.9	Minimum Non-Detect	1.9
Maximum Detect	39	Maximum Non-Detect	7.6
Variance Detects	182.5	Percent Non-Detects	88.37%
Mean Detects	20.98	SD Detects	13.51
Median Detects	21	CV Detects	0.644
Skewness Detects	-0.174	Kurtosis Detects	0.969
Mean of Logged Detects	2.688	SD of Logged Detects	1.184

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.986	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.396	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	4.119	Standard Error of Mean	1.257
SD	7.374	95% KM (BCA) UCL	6.263
95% KM (t) UCL	6.233	95% KM (Percentile Bootstrap) UCL	6.195
95% KM (z) UCL	6.187	95% KM Bootstrap t UCL	5.85
90% KM Chebyshev UCL	7.891	95% KM Chebyshev UCL	9.599
97.5% KM Chebyshev UCL	11.97	99% KM Chebyshev UCL	16.63

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.463	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.686	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.308	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.362	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.553	k star (bias corrected MLE)	0.754
Theta hat (MLE)	13.51	Theta star (bias corrected MLE)	27.81
nu hat (MLE)	15.53	nu star (bias corrected)	7.545
MLE Mean (bias corrected)	20.98	MLE Sd (bias corrected)	24.15

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.312	nu hat (KM)	26.83
Approximate Chi Square Value (26.83, α)	16.02	Adjusted Chi Square Value (26.83, β)	15.73
95% Gamma Approximate KM-UCL (use when n>=50)	6.898	95% Gamma Adjusted KM-UCL (use when n<50)	7.026

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.454
Maximum	39	Median	0.01
SD	7.976	CV	3.25
k hat (MLE)	0.165	k star (bias corrected MLE)	0.169
Theta hat (MLE)	14.83	Theta star (bias corrected MLE)	14.49
nu hat (MLE)	14.23	nu star (bias corrected)	14.57
MLE Mean (bias corrected)	2.454	MLE Sd (bias corrected)	5.963
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (14.57, α)	6.962	Adjusted Chi Square Value (14.57, β)	6.779
95% Gamma Approximate UCL (use when n>=50)	5.135	95% Gamma Adjusted UCL (use when n<50)	5.274

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.794	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.349	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.396	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.724	Mean in Log Scale	-2.331
SD in Original Scale	7.911	SD in Log Scale	2.924
95% t UCL (assumes normality of ROS data)	4.753	95% Percentile Bootstrap UCL	4.818
95% BCA Bootstrap UCL	5.555	95% Bootstrap t UCL	6.931

95% H-UCL (Log ROS)	67.94

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	0.88	95% H-UCL (KM -Log)	4.071
KM SD (logged)	0.749	95% Critical H Value (KM-Log)	2.108
KM Standard Error of Mean (logged)	0.128		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	3.345	Mean in Log Scale	0.299
SD in Original Scale	7.711	SD in Log Scale	0.973
95% t UCL (Assumes normality)	5.323	95% H-Stat UCL	3.075

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	6.233	95% KM (Percentile Bootstrap) UCL	6.195

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Acetophenone

General Statistics

Total Number of Observations	43	Number of Distinct Observations	6
Number of Detects	6	Number of Non-Detects	37
Number of Distinct Detects	4	Number of Distinct Non-Detects	2
Minimum Detect	0.26	Minimum Non-Detect	0.23
Maximum Detect	4.2	Maximum Non-Detect	0.91
Variance Detects	3.879	Percent Non-Detects	86.05%
Mean Detects	2.073	SD Detects	1.97
Median Detects	1.72	CV Detects	0.95
Skewness Detects	0.155	Kurtosis Detects	-2.953
Mean of Logged Detects	0.0828	SD of Logged Detects	1.378

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.768	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.311	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.362	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.487	Standard Error of Mean	0.155
SD	0.927	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.748	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.742	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.952	95% KM Chebyshev UCL	1.162
97.5% KM Chebyshev UCL	1.454	99% KM Chebyshev UCL	2.028

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.806	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.717	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.328	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.342	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.904	k star (bias corrected MLE)	0.563
Theta hat (MLE)	2.294	Theta star (bias corrected MLE)	3.682
nu hat (MLE)	10.85	nu star (bias corrected)	6.757
MLE Mean (bias corrected)	2.073	MLE Sd (bias corrected)	2.763

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.277	nu hat (KM)	23.78
Approximate Chi Square Value (23.78, α)	13.68	Adjusted Chi Square Value (23.78, β)	13.41
95% Gamma Approximate KM-UCL (use when n>=50)	0.847	95% Gamma Adjusted KM-UCL (use when n<50)	0.864

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.298
Maximum	4.2	Median	0.01
SD	0.993	CV	3.332
k hat (MLE)	0.258	k star (bias corrected MLE)	0.255
Theta hat (MLE)	1.155	Theta star (bias corrected MLE)	1.166
nu hat (MLE)	22.18	nu star (bias corrected)	21.97
MLE Mean (bias corrected)	0.298	MLE Sd (bias corrected)	0.589
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (21.97, α)	12.31	Adjusted Chi Square Value (21.97, β)	12.06
95% Gamma Approximate UCL (use when n>=50)	0.531	95% Gamma Adjusted UCL (use when n<50)	0.543

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.761	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.3	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.362	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.304	Mean in Log Scale	-5.275
SD in Original Scale	0.991	SD in Log Scale	3.291
95% t UCL (assumes normality of ROS data)	0.558	95% Percentile Bootstrap UCL	0.581
95% BCA Bootstrap UCL	0.67	95% Bootstrap t UCL	0.742
95% H-UCL (Log ROS)	19.77		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-1.253	95% H-UCL (KM -Log)	0.464
KM SD (logged)	0.714	95% Critical H Value (KM-Log)	2.077
KM Standard Error of Mean (logged)	0.119		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.396	Mean in Log Scale	-1.817
SD in Original Scale	0.965	SD in Log Scale	0.932
95% t UCL (Assumes normality)	0.644	95% H-Stat UCL	0.349

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.748	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Carbazole

General Statistics

Total Number of Observations	43	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	38
Number of Distinct Detects	4	Number of Distinct Non-Detects	2
Minimum Detect	0.44	Minimum Non-Detect	0.41
Maximum Detect	1.4	Maximum Non-Detect	1.6
Variance Detects	0.151	Percent Non-Detects	88.37%
Mean Detects	1.108	SD Detects	0.389
Median Detects	1.3	CV Detects	0.351
Skewness Detects	-1.834	Kurtosis Detects	3.415
Mean of Logged Detects	0.0271	SD of Logged Detects	0.482

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.778	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.292	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.396	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.493	Standard Error of Mean	0.0442
SD	0.256	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.567	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.566	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.626	95% KM Chebyshev UCL	0.686
97.5% KM Chebyshev UCL	0.769	99% KM Chebyshev UCL	0.932

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.802	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.68	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.344	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.789	k star (bias corrected MLE)	2.849
Theta hat (MLE)	0.163	Theta star (bias corrected MLE)	0.389
nu hat (MLE)	67.89	nu star (bias corrected)	28.49
MLE Mean (bias corrected)	1.108	MLE Sd (bias corrected)	0.656

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	3.712	nu hat (KM)	319.2
Approximate Chi Square Value (319.21, α)	278.8	Adjusted Chi Square Value (319.21, β)	277.5
95% Gamma Approximate KM-UCL (use when n>=50)	0.565	95% Gamma Adjusted KM-UCL (use when n<50)	0.567

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detected data is small such as < 0.1
For such situations, GROS method tends to yield inflated values of UCLs and BTVs
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.207
Maximum	1.4	Median	0.01

SD	0.383	CV	1.852
k hat (MLE)	0.382	k star (bias corrected MLE)	0.371
Theta hat (MLE)	0.541	Theta star (bias corrected MLE)	0.557
nu hat (MLE)	32.85	nu star (bias corrected)	31.89
MLE Mean (bias corrected)	0.207	MLE Sd (bias corrected)	0.339
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (31.89, α)	19.99	Adjusted Chi Square Value (31.89, β)	19.66
95% Gamma Approximate UCL (use when n>=50)	0.33	95% Gamma Adjusted UCL (use when n<50)	0.335

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.704	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.356	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.396	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.287	Mean in Log Scale	-1.811
SD in Original Scale	0.35	SD in Log Scale	1.078
95% t UCL (assumes normality of ROS data)	0.376	95% Percentile Bootstrap UCL	0.373
95% BCA Bootstrap UCL	0.4	95% Bootstrap t UCL	0.412
95% H-UCL (Log ROS)	0.439		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.782	95% H-UCL (KM -Log)	0.53
KM SD (logged)	0.333	95% Critical H Value (KM-Log)	1.796
KM Standard Error of Mean (logged)	0.0574		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.324	Mean in Log Scale	-1.366
SD in Original Scale	0.325	SD in Log Scale	0.571
95% t UCL (Assumes normality)	0.407	95% H-Stat UCL	0.357

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.567	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenzofuran

General Statistics

Total Number of Observations	43	Number of Distinct Observations	10
Number of Detects	8	Number of Non-Detects	35
Number of Distinct Detects	8	Number of Distinct Non-Detects	2
Minimum Detect	0.33	Minimum Non-Detect	0.27
Maximum Detect	3.7	Maximum Non-Detect	0.28
Variance Detects	1.494	Percent Non-Detects	81.4%
Mean Detects	1.68	SD Detects	1.222
Median Detects	1.25	CV Detects	0.727
Skewness Detects	1.015	Kurtosis Detects	-0.354
Mean of Logged Detects	0.274	SD of Logged Detects	0.781

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.853	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.247	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.313	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.532	Standard Error of Mean	0.12
SD	0.738	95% KM (BCA) UCL	0.728
95% KM (t) UCL	0.735	95% KM (Percentile Bootstrap) UCL	0.737
95% KM (z) UCL	0.73	95% KM Bootstrap t UCL	0.866
90% KM Chebyshev UCL	0.893	95% KM Chebyshev UCL	1.057
97.5% KM Chebyshev UCL	1.283	99% KM Chebyshev UCL	1.729

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.314	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.723	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.178	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.191	k star (bias corrected MLE)	1.452
Theta hat (MLE)	0.767	Theta star (bias corrected MLE)	1.157
nu hat (MLE)	35.05	nu star (bias corrected)	23.24
MLE Mean (bias corrected)	1.68	MLE Sd (bias corrected)	1.394

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.521	nu hat (KM)	44.78
Approximate Chi Square Value (44.78, α)	30.43	Adjusted Chi Square Value (44.78, β)	30.02
95% Gamma Approximate KM-UCL (use when n>=50)	0.783	95% Gamma Adjusted KM-UCL (use when n<50)	0.794

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.321
Maximum	3.7	Median	0.01
SD	0.825	CV	2.574
k hat (MLE)	0.273	k star (bias corrected MLE)	0.27
Theta hat (MLE)	1.173	Theta star (bias corrected MLE)	1.188
nu hat (MLE)	23.52	nu star (bias corrected)	23.21
MLE Mean (bias corrected)	0.321	MLE Sd (bias corrected)	0.617
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (23.21, α)	13.25	Adjusted Chi Square Value (23.21, β)	12.99
95% Gamma Approximate UCL (use when n>=50)	0.562	95% Gamma Adjusted UCL (use when n<50)	0.573

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.313	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.386	Mean in Log Scale	-2.514
SD in Original Scale	0.806	SD in Log Scale	1.876

95% t UCL (assumes normality of ROS data)	0.592	95% Percentile Bootstrap UCL	0.608
95% BCA Bootstrap UCL	0.65	95% Bootstrap t UCL	0.801
95% H-UCL (Log ROS)	1.29		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-1.015	95% H-UCL (KM -Log)	0.574
KM SD (logged)	0.692	95% Critical H Value (KM-Log)	2.057
KM Standard Error of Mean (logged)	0.113		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.426	Mean in Log Scale	-1.555
SD in Original Scale	0.786	SD in Log Scale	0.94
95% t UCL (Assumes normality)	0.627	95% H-Stat UCL	0.459

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.735	95% KM (Percentile Bootstrap) UCL	0.737

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dimethyl phthalate

General Statistics

Total Number of Observations	43	Number of Distinct Observations	4
Number of Detects	2	Number of Non-Detects	41
Number of Distinct Detects	2	Number of Distinct Non-Detects	2
Minimum Detect	0.42	Minimum Non-Detect	0.2
Maximum Detect	0.53	Maximum Non-Detect	0.8
Variance Detects	0.00605	Percent Non-Detects	95.35%
Mean Detects	0.475	SD Detects	0.0778
Median Detects	0.475	CV Detects	0.164
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-0.751	SD of Logged Detects	0.164

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.213	Standard Error of Mean	0.013
SD	0.0598	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.235	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.235	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.252	95% KM Chebyshev UCL	0.27
97.5% KM Chebyshev UCL	0.295	99% KM Chebyshev UCL	0.343

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	74.25	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0064	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	297	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	12.71	nu hat (KM)	1093
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (N/A, α)	1017	Adjusted Chi Square Value (N/A, β)	1014
95% Gamma Approximate KM-UCL (use when n>=50)	0.229	95% Gamma Adjusted KM-UCL (use when n<50)	0.23

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.126	Mean in Log Scale	-2.342
SD in Original Scale	0.105	SD in Log Scale	0.748
95% t UCL (assumes normality of ROS data)	0.153	95% Percentile Bootstrap UCL	0.154
95% BCA Bootstrap UCL	0.16	95% Bootstrap t UCL	0.16
95% H-UCL (Log ROS)	0.162		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.124	Mean in Log Scale	-2.198
SD in Original Scale	0.0915	SD in Log Scale	0.387
95% t UCL (Assumes normality)	0.148	95% H-Stat UCL	0.133

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.235	95% KM (% Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Pentachlorophenol

General Statistics

Total Number of Observations	43	Number of Distinct Observations	3
Number of Detects	1	Number of Non-Detects	42
Number of Distinct Detects	1	Number of Distinct Non-Detects	2

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, B

The data set for variable Pentachlorophenol was not processed!

Naphthalene

General Statistics

Total Number of Observations	39	Number of Distinct Observations	19
Number of Detects	16	Number of Non-Detects	23
Number of Distinct Detects	15	Number of Distinct Non-Detects	4
Minimum Detect	0.0074	Minimum Non-Detect	0.0049
Maximum Detect	30	Maximum Non-Detect	0.0052

Variance Detects	131.1	Percent Non-Detects	58.97%
Mean Detects	8.305	SD Detects	11.45
Median Detects	0.86	CV Detects	1.379
Skewness Detects	1.013	Kurtosis Detects	-0.695
Mean of Logged Detects	-0.203	SD of Logged Detects	3.011

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.729	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.328	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.222	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	3.41	Standard Error of Mean	1.355
SD	8.192	95% KM (BCA) UCL	5.822
95% KM (t) UCL	5.694	95% KM (Percentile Bootstrap) UCL	5.774
95% KM (z) UCL	5.638	95% KM Bootstrap t UCL	6.464
90% KM Chebyshev UCL	7.474	95% KM Chebyshev UCL	9.315
97.5% KM Chebyshev UCL	11.87	99% KM Chebyshev UCL	16.89

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.657	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.839	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.182	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.233	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.298	k star (bias corrected MLE)	0.283
Theta hat (MLE)	27.91	Theta star (bias corrected MLE)	29.3
nu hat (MLE)	9.522	nu star (bias corrected)	9.07
MLE Mean (bias corrected)	8.305	MLE Sd (bias corrected)	15.6

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.173	nu hat (KM)	13.52
Approximate Chi Square Value (13.52, α)	6.242	Adjusted Chi Square Value (13.52, β)	6.047
95% Gamma Approximate KM-UCL (use when n>=50)	7.384	95% Gamma Adjusted KM-UCL (use when n<50)	7.623

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0074	Mean	3.413
Maximum	30	Median	0.01
SD	8.297	CV	2.431
k hat (MLE)	0.185	k star (bias corrected MLE)	0.188
Theta hat (MLE)	18.45	Theta star (bias corrected MLE)	18.17
nu hat (MLE)	14.43	nu star (bias corrected)	14.65
MLE Mean (bias corrected)	3.413	MLE Sd (bias corrected)	7.875
		Adjusted Level of Significance (β)	0.0437
Approximate Chi Square Value (14.65, α)	7.02	Adjusted Chi Square Value (14.65, β)	6.811
95% Gamma Approximate UCL (use when n>=50)	7.124	95% Gamma Adjusted UCL (use when n<50)	7.342

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.156	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.222	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.408	Mean in Log Scale	-5.317
SD in Original Scale	8.3	SD in Log Scale	5.192
95% t UCL (assumes normality of ROS data)	5.649	95% Percentile Bootstrap UCL	5.689
95% BCA Bootstrap UCL	6.305	95% Bootstrap t UCL	7.052
95% H-UCL (Log ROS)	6099623		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.22	95% H-UCL (KM -Log)	89.35
KM SD (logged)	3.133	95% Critical H Value (KM-Log)	5.516
KM Standard Error of Mean (logged)	0.518		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	3.409	Mean in Log Scale	-3.611
SD in Original Scale	8.299	SD in Log Scale	3.445
95% t UCL (Assumes normality)	5.649	95% H-Stat UCL	294.5

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	5.694	95% GROS Adjusted Gamma UCL	7.342
95% Adjusted Gamma KM-UCL	7.623		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benz(a)anthracene

General Statistics

Total Number of Observations	43	Number of Distinct Observations	17
Number of Detects	13	Number of Non-Detects	30
Number of Distinct Detects	13	Number of Distinct Non-Detects	4
Minimum Detect	0.01	Minimum Non-Detect	0.003
Maximum Detect	0.53	Maximum Non-Detect	0.0051
Variance Detects	0.0234	Percent Non-Detects	69.77%
Mean Detects	0.128	SD Detects	0.153
Median Detects	0.048	CV Detects	1.199
Skewness Detects	1.703	Kurtosis Detects	3.018
Mean of Logged Detects	-2.768	SD of Logged Detects	1.288

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.767	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.305	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.246	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0407	Standard Error of Mean	0.0157
SD	0.0991	95% KM (BCA) UCL	0.0656
95% KM (t) UCL	0.0672	95% KM (Percentile Bootstrap) UCL	0.0688
95% KM (z) UCL	0.0666	95% KM Bootstrap t UCL	0.089
90% KM Chebyshev UCL	0.0879	95% KM Chebyshev UCL	0.109

97.5% KM Chebyshev UCL	0.139	99% KM Chebyshev UCL	0.197

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.614	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.766	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.243	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.832	k star (bias corrected MLE)	0.691
Theta hat (MLE)	0.153	Theta star (bias corrected MLE)	0.185
nu hat (MLE)	21.63	nu star (bias corrected)	17.97
MLE Mean (bias corrected)	0.128	MLE Sd (bias corrected)	0.154

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.169	nu hat (KM)	14.5
Approximate Chi Square Value (14.50, α)	6.915	Adjusted Chi Square Value (14.50, β)	6.733
95% Gamma Approximate KM-UCL (use when n>=50)	0.0853	95% Gamma Adjusted KM-UCL (use when n<50)	0.0876

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0456
Maximum	0.53	Median	0.01
SD	0.0984	CV	2.16
k hat (MLE)	0.637	k star (bias corrected MLE)	0.608
Theta hat (MLE)	0.0715	Theta star (bias corrected MLE)	0.075
nu hat (MLE)	54.79	nu star (bias corrected)	52.3
MLE Mean (bias corrected)	0.0456	MLE Sd (bias corrected)	0.0585
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (52.30, α)	36.69	Adjusted Chi Square Value (52.30, β)	36.23
95% Gamma Approximate UCL (use when n>=50)	0.065	95% Gamma Adjusted UCL (use when n<50)	0.0658

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.246	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0398	Mean in Log Scale	-5.901
SD in Original Scale	0.101	SD in Log Scale	2.575
95% t UCL (assumes normality of ROS data)	0.0657	95% Percentile Bootstrap UCL	0.0677
95% BCA Bootstrap UCL	0.0724	95% Bootstrap t UCL	0.0891
95% H-UCL (Log ROS)	0.451		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-4.89	95% H-UCL (KM -Log)	0.0522
KM SD (logged)	1.554	95% Critical H Value (KM-Log)	3.044
KM Standard Error of Mean (logged)	0.247		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0398	Mean in Log Scale	-5.272
SD in Original Scale	0.101	SD in Log Scale	1.813
95% t UCL (Assumes normality)	0.0657	95% H-Stat UCL	0.0688

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0672	95% GROS Adjusted Gamma UCL	0.0658
95% Adjusted Gamma KM-UCL	0.0876		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benzo(a)pyrene

General Statistics

Total Number of Observations	43	Number of Distinct Observations	16
Number of Detects	12	Number of Non-Detects	31
Number of Distinct Detects	12	Number of Distinct Non-Detects	4
Minimum Detect	0.012	Minimum Non-Detect	0.0033
Maximum Detect	0.5	Maximum Non-Detect	0.005
Variance Detects	0.0191	Percent Non-Detects	72.09%
Mean Detects	0.0739	SD Detects	0.138
Median Detects	0.0245	CV Detects	1.867
Skewness Detects	3.16	Kurtosis Detects	10.31
Mean of Logged Detects	-3.372	SD of Logged Detects	1.073

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.487	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.399	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.256	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.023	Standard Error of Mean	0.0122
SD	0.0767	95% KM (BCA) UCL	0.0469
95% KM (t) UCL	0.0435	95% KM (Percentile Bootstrap) UCL	0.0433
95% KM (z) UCL	0.0431	95% KM Bootstrap t UCL	0.131
90% KM Chebyshev UCL	0.0596	95% KM Chebyshev UCL	0.0762
97.5% KM Chebyshev UCL	0.0993	99% KM Chebyshev UCL	0.145

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.501	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.765	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.3	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.255	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.777	k star (bias corrected MLE)	0.638
Theta hat (MLE)	0.0951	Theta star (bias corrected MLE)	0.116
nu hat (MLE)	18.65	nu star (bias corrected)	15.32
MLE Mean (bias corrected)	0.0739	MLE Sd (bias corrected)	0.0925

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0901	nu hat (KM)	7.745
Approximate Chi Square Value (7.75, α)	2.588	Adjusted Chi Square Value (7.75, β)	2.486
95% Gamma Approximate KM-UCL (use when n>=50)	0.0688	95% Gamma Adjusted KM-UCL (use when n<50)	0.0717

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detected data is small such as < 0.1
For such situations, GROS method tends to yield inflated values of UCLs and BTVs
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0278
Maximum	0.5	Median	0.01
SD	0.0764	CV	2.743
k hat (MLE)	0.865	k star (bias corrected MLE)	0.82
Theta hat (MLE)	0.0322	Theta star (bias corrected MLE)	0.034
nu hat (MLE)	74.36	nu star (bias corrected)	70.51
MLE Mean (bias corrected)	0.0278	MLE Sd (bias corrected)	0.0307
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (70.51, α)	52.17	Adjusted Chi Square Value (70.51, β)	51.63
95% Gamma Approximate UCL (use when n>=50)	0.0376	95% Gamma Adjusted UCL (use when n<50)	0.038

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.83	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.217	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.256	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0217	Mean in Log Scale	-6.189
SD in Original Scale	0.0779	SD in Log Scale	2.24
95% t UCL (assumes normality of ROS data)	0.0417	95% Percentile Bootstrap UCL	0.0438
95% BCA Bootstrap UCL	0.0569	95% Bootstrap t UCL	0.124
95% H-UCL (Log ROS)	0.101		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-5.06	95% H-UCL (KM -Log)	0.0204
KM SD (logged)	1.183	95% Critical H Value (KM-Log)	2.572
KM Standard Error of Mean (logged)	0.188		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0222	Mean in Log Scale	-5.347
SD in Original Scale	0.0778	SD in Log Scale	1.368
95% t UCL (Assumes normality)	0.0422	95% H-Stat UCL	0.0219

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	0.0469

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	43	Number of Distinct Observations	16
Number of Detects	13	Number of Non-Detects	30

Number of Distinct Detects	12	Number of Distinct Non-Detects	4
Minimum Detect	0.0083	Minimum Non-Detect	0.0032
Maximum Detect	0.65	Maximum Non-Detect	0.0035
Variance Detects	0.0306	Percent Non-Detects	69.77%
Mean Detects	0.1	SD Detects	0.175
Median Detects	0.04	CV Detects	1.743
Skewness Detects	3.035	Kurtosis Detects	9.626
Mean of Logged Detects	-3.068	SD of Logged Detects	1.151

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.534	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.37	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.246	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0326	Standard Error of Mean	0.0163
SD	0.103	95% KM (BCA) UCL	0.0621
95% KM (t) UCL	0.0599	95% KM (Percentile Bootstrap) UCL	0.0612
95% KM (z) UCL	0.0593	95% KM Bootstrap t UCL	0.152
90% KM Chebyshev UCL	0.0814	95% KM Chebyshev UCL	0.104
97.5% KM Chebyshev UCL	0.134	99% KM Chebyshev UCL	0.195

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.074	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.769	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.288	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.246	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.776	k star (bias corrected MLE)	0.648
Theta hat (MLE)	0.129	Theta star (bias corrected MLE)	0.155
nu hat (MLE)	20.17	nu star (bias corrected)	16.85
MLE Mean (bias corrected)	0.1	MLE Sd (bias corrected)	0.125

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.101	nu hat (KM)	8.669
Approximate Chi Square Value (8.67, α)	3.128	Adjusted Chi Square Value (8.67, β)	3.013
95% Gamma Approximate KM-UCL (use when n>=50)	0.0902	95% Gamma Adjusted KM-UCL (use when n<50)	0.0937

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0083	Mean	0.0373
Maximum	0.65	Median	0.01
SD	0.102	CV	2.746
k hat (MLE)	0.708	k star (bias corrected MLE)	0.674
Theta hat (MLE)	0.0527	Theta star (bias corrected MLE)	0.0553
nu hat (MLE)	60.91	nu star (bias corrected)	58
MLE Mean (bias corrected)	0.0373	MLE Sd (bias corrected)	0.0454
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (58.00, α)	41.49	Adjusted Chi Square Value (58.00, β)	41
95% Gamma Approximate UCL (use when n>=50)	0.0522	95% Gamma Adjusted UCL (use when n<50)	0.0528

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.246	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0316	Mean in Log Scale	-5.907
SD in Original Scale	0.104	SD in Log Scale	2.347
95% t UCL (assumes normality of ROS data)	0.0583	95% Percentile Bootstrap UCL	0.0603
95% BCA Bootstrap UCL	0.0828	95% Bootstrap t UCL	0.151
95% H-UCL (Log ROS)	0.193		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-4.935	95% H-UCL (KM -Log)	0.0334
KM SD (logged)	1.372	95% Critical H Value (KM-Log)	2.806
KM Standard Error of Mean (logged)	0.218		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0315	Mean in Log Scale	-5.392
SD in Original Scale	0.104	SD in Log Scale	1.666
95% t UCL (Assumes normality)	0.0582	95% H-Stat UCL	0.0415

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	0.0621

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chrysene

General Statistics

Total Number of Observations	43	Number of Distinct Observations	17
Number of Detects	13	Number of Non-Detects	30
Number of Distinct Detects	13	Number of Distinct Non-Detects	4
Minimum Detect	0.0085	Minimum Non-Detect	0.003
Maximum Detect	1	Maximum Non-Detect	0.0048
Variance Detects	0.0701	Percent Non-Detects	69.77%
Mean Detects	0.147	SD Detects	0.265
Median Detects	0.049	CV Detects	1.801
Skewness Detects	3.23	Kurtosis Detects	10.95
Mean of Logged Detects	-2.732	SD of Logged Detects	1.222

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.52	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.327	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.246	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0465	Standard Error of Mean	0.0246
SD	0.155	95% KM (BCA) UCL	0.0931
95% KM (t) UCL	0.0879	95% KM (Percentile Bootstrap) UCL	0.0916

95% KM (z) UCL	0.087	95% KM Bootstrap t UCL	0.191
90% KM Chebyshev UCL	0.12	95% KM Chebyshev UCL	0.154
97.5% KM Chebyshev UCL	0.2	99% KM Chebyshev UCL	0.291

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.837	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.771	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.199	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.736	k star (bias corrected MLE)	0.618
Theta hat (MLE)	0.2	Theta star (bias corrected MLE)	0.238
nu hat (MLE)	19.14	nu star (bias corrected)	16.06
MLE Mean (bias corrected)	0.147	MLE Sd (bias corrected)	0.187

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0905	nu hat (KM)	7.78
Approximate Chi Square Value (7.78, α)	2.608	Adjusted Chi Square Value (7.78, β)	2.505
95% Gamma Approximate KM-UCL (use when n>=50)	0.139	95% Gamma Adjusted KM-UCL (use when n<50)	0.145

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0085	Mean	0.0514
Maximum	1	Median	0.01
SD	0.155	CV	3.018
k hat (MLE)	0.58	k star (bias corrected MLE)	0.555
Theta hat (MLE)	0.0887	Theta star (bias corrected MLE)	0.0927
nu hat (MLE)	49.85	nu star (bias corrected)	47.71
MLE Mean (bias corrected)	0.0514	MLE Sd (bias corrected)	0.0691
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (47.71, α)	32.85	Adjusted Chi Square Value (47.71, β)	32.43
95% Gamma Approximate UCL (use when n>=50)	0.0747	95% Gamma Adjusted UCL (use when n<50)	0.0757

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.13	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.246	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0459	Mean in Log Scale	-5.748
SD in Original Scale	0.157	SD in Log Scale	2.489
95% t UCL (assumes normality of ROS data)	0.0861	95% Percentile Bootstrap UCL	0.0886
95% BCA Bootstrap UCL	0.127	95% Bootstrap t UCL	0.184
95% H-UCL (Log ROS)	0.38		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-4.879	95% H-UCL (KM -Log)	0.0527
KM SD (logged)	1.554	95% Critical H Value (KM-Log)	3.043
KM Standard Error of Mean (logged)	0.247		

DL/2 Statistics

DL/2 Normal	**DL/2 Log-Transformed**

Mean in Original Scale	0.0457	Mean in Log Scale	-5.28
SD in Original Scale	0.157	SD in Log Scale	1.825
95% t UCL (Assumes normality)	0.0859	95% H-Stat UCL	0.0705

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0879	95% GROS Adjusted Gamma UCL	0.0757
95% Adjusted Gamma KM-UCL	0.145		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	43	Number of Distinct Observations	10
Number of Detects	6	Number of Non-Detects	37
Number of Distinct Detects	6	Number of Distinct Non-Detects	4
Minimum Detect	0.0066	Minimum Non-Detect	0.0043
Maximum Detect	0.2	Maximum Non-Detect	0.0047
Variance Detects	0.00495	Percent Non-Detects	86.05%
Mean Detects	0.0641	SD Detects	0.0703
Median Detects	0.0435	CV Detects	1.097
Skewness Detects	1.906	Kurtosis Detects	3.951
Mean of Logged Detects	-3.248	SD of Logged Detects	1.159

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.793	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.294	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.362	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0126	Standard Error of Mean	0.00529
SD	0.0317	95% KM (BCA) UCL	0.0213
95% KM (t) UCL	0.0215	95% KM (Percentile Bootstrap) UCL	0.0215
95% KM (z) UCL	0.0214	95% KM Bootstrap t UCL	0.0299
90% KM Chebyshev UCL	0.0285	95% KM Chebyshev UCL	0.0357
97.5% KM Chebyshev UCL	0.0457	99% KM Chebyshev UCL	0.0653

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.202	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.713	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.169	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.34	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.137	k star (bias corrected MLE)	0.679
Theta hat (MLE)	0.0564	Theta star (bias corrected MLE)	0.0944
nu hat (MLE)	13.64	nu star (bias corrected)	8.152
MLE Mean (bias corrected)	0.0641	MLE Sd (bias corrected)	0.0778

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.159	nu hat (KM)	13.69
Approximate Chi Square Value (13.69, α)	6.359	Adjusted Chi Square Value (13.69, β)	6.185
95% Gamma Approximate KM-UCL (use when n>=50)	0.0272	95% Gamma Adjusted KM-UCL (use when n<50)	0.028

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0066	Mean	0.0175
Maximum	0.2	Median	0.01
SD	0.0308	CV	1.755
k hat (MLE)	1.485	k star (bias corrected MLE)	1.397
Theta hat (MLE)	0.0118	Theta star (bias corrected MLE)	0.0126
nu hat (MLE)	127.7	nu star (bias corrected)	120.1
MLE Mean (bias corrected)	0.0175	MLE Sd (bias corrected)	0.0148
		Adjusted Level of Significance (β)	0.0444
Approximate Chi Square Value (120.14, α)	95.83	Adjusted Chi Square Value (120.14, β)	95.08
95% Gamma Approximate UCL (use when n>=50)	0.022	95% Gamma Adjusted UCL (use when n<50)	0.0222

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.992	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.14	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.362	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00948	Mean in Log Scale	-8.468
SD in Original Scale	0.0329	SD in Log Scale	3.132
95% t UCL (assumes normality of ROS data)	0.0179	95% Percentile Bootstrap UCL	0.0184
95% BCA Bootstrap UCL	0.0251	95% Bootstrap t UCL	0.0372
95% H-UCL (Log ROS)	0.378		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-5.142	95% H-UCL (KM -Log)	0.0113
KM SD (logged)	0.859	95% Critical H Value (KM-Log)	2.212
KM Standard Error of Mean (logged)	0.143		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0109	Mean in Log Scale	-5.687
SD in Original Scale	0.0325	SD in Log Scale	1.071
95% t UCL (Assumes normality)	0.0193	95% H-Stat UCL	0.00901

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0215	95% KM (Percentile Bootstrap) UCL	0.0215

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	49	Number of Distinct Observations	11
Number of Detects	6	Number of Non-Detects	43
Number of Distinct Detects	5	Number of Distinct Non-Detects	7
Minimum Detect	0.015	Minimum Non-Detect	0.014
Maximum Detect	0.32	Maximum Non-Detect	33
Variance Detects	0.0144	Percent Non-Detects	87.76%
Mean Detects	0.0817	SD Detects	0.12
Median Detects	0.024	CV Detects	1.469
Skewness Detects	2.187	Kurtosis Detects	4.837
Mean of Logged Detects	-3.206	SD of Logged Detects	1.19

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.648	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.351	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.362	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0256	Standard Error of Mean	0.00963
SD	0.052	95% KM (BCA) UCL	0.0433
95% KM (t) UCL	0.0418	95% KM (Percentile Bootstrap) UCL	0.0421
95% KM (z) UCL	0.0415	95% KM Bootstrap t UCL	0.224
90% KM Chebyshev UCL	0.0545	95% KM Chebyshev UCL	0.0676
97.5% KM Chebyshev UCL	0.0858	99% KM Chebyshev UCL	0.121

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.768	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.719	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.374	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.342	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.841	k star (bias corrected MLE)	0.532
Theta hat (MLE)	0.0971	Theta star (bias corrected MLE)	0.154
nu hat (MLE)	10.1	nu star (bias corrected)	6.382
MLE Mean (bias corrected)	0.0817	MLE Sd (bias corrected)	0.112

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.242	nu hat (KM)	23.73
Approximate Chi Square Value (23.73, α)	13.64	Adjusted Chi Square Value (23.73, β)	13.41
95% Gamma Approximate KM-UCL (use when n>=50)	0.0445	95% Gamma Adjusted KM-UCL (use when n<50)	0.0453

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0188
Maximum	0.32	Median	0.01
SD	0.0454	CV	2.419
k hat (MLE)	1.23	k star (bias corrected MLE)	1.168
Theta hat (MLE)	0.0153	Theta star (bias corrected MLE)	0.0161
nu hat (MLE)	120.6	nu star (bias corrected)	114.5
MLE Mean (bias corrected)	0.0188	MLE Sd (bias corrected)	0.0174
		Adjusted Level of Significance (β)	0.0451
Approximate Chi Square Value (114.51, α)	90.8	Adjusted Chi Square Value (114.51, β)	90.16
95% Gamma Approximate UCL (use when n>=50)	0.0237	95% Gamma Adjusted UCL (use when n<50)	0.0238

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.824	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.337	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.362	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0111	Mean in Log Scale	-7.605
SD in Original Scale	0.047	SD in Log Scale	2.614
95% t UCL (assumes normality of ROS data)	0.0224	95% Percentile Bootstrap UCL	0.0242
95% BCA Bootstrap UCL	0.0326	95% Bootstrap t UCL	0.088
95% H-UCL (Log ROS)	0.0827		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-4.086	95% H-UCL (KM -Log)	0.0239
KM SD (logged)	0.602	95% Critical H Value (KM-Log)	1.965
KM Standard Error of Mean (logged)	0.112		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.417	Mean in Log Scale	-3.013
SD in Original Scale	3.297	SD in Log Scale	2.761
95% t UCL (Assumes normality)	2.207	95% H-Stat UCL	14.51

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0418	95% KM (Percentile Bootstrap) UCL	0.0421

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B1.1
SMA 4, Surface Soil 0 - 1 ft, Daily Intake Calculations: Industrial/Commercial Worker
Ingestion of Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	$DI_{ingestion}$	= [	CS	x	IR	x	FI	x	CF	x	EF	x	ED	] / [	BW	x	AT	]
Units	mg/kg-day		mg/kg		mg soil/day		unitless		kg/mg		days/year		years		kg		days	
CARCINOGENIC EFFECTS																		
Carbazole	3.33E-08	= [	1.09E-01	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	25,550	]
Benz(a)anthracene	1.38E-06	= [	4.51E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	25,550	]
Benzo(a)pyrene	1.55E-06	= [	5.07E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	25,550	]
Benzo(b)fluoranthene	2.59E-06	= [	8.48E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	25,550	]
Chrysene	2.19E-06	= [	7.17E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	25,550	]
Dibenz(a,h)anthracene	4.49E-07	= [	1.47E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	1.28E-06	= [	4.20E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	25,550	]
Arsenic	6.08E-06	= [	1.99E+01	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	25,550	]
Chromium	1.54E-05	= [	5.03E+01	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	25,550	]
NONCARCINOGENIC EFFECTS																		
Carbazole	9.33E-08	= [	1.09E-01	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	9,125	]
Benz(a)anthracene	3.86E-06	= [	4.51E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	9,125	]
Benzo(a)pyrene	4.34E-06	= [	5.07E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	9,125	]
Benzo(b)fluoranthene	7.26E-06	= [	8.48E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	9,125	]
Chrysene	6.14E-06	= [	7.17E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	9,125	]
Dibenz(a,h)anthracene	1.26E-06	= [	1.47E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	9,125	]
Indeno(1,2,3-cd)pyrene	3.59E-06	= [	4.20E+00	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	9,125	]
Arsenic	1.70E-05	= [	1.99E+01	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	9,125	]
Chromium	4.31E-05	= [	5.03E+01	x	100	x	1	x	1.00E-06	x	250	x	25	] / [	80	x	9,125	]

$DI_{ingestion}$ = daily chemical intake via soil ingestion
CS = chemical concentration in soil
IR = soil ingestion rate
FI = fraction of intake
CF = conversion factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

Table B1.2
SMA 4, Surface Soil 0 - 1 ft, Daily Intake Calculations: Construction Worker
Ingestion of Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	$DI_{ingestion}$	= [	CS	x	IR	x	FI	x	CF	x	EF	x	ED	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/kg**		**mg soil/day**		**unitless**		**kg/mg**		**days/year**		**years**		**kg**		**days**	
CARCINOGENIC EFFECTS																		
Carbazole	6.34E-10	= [	1.09E-01	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	25,550	]
Benz(a)anthracene	2.62E-08	= [	4.51E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	25,550	]
Benzo(a)pyrene	2.95E-08	= [	5.07E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	25,550	]
Benzo(b)fluoranthene	4.93E-08	= [	8.48E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	25,550	]
Chrysene	4.16E-08	= [	7.17E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	25,550	]
Dibenz(a,h)anthracene	8.54E-09	= [	1.47E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	2.44E-08	= [	4.20E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	25,550	]
Arsenic	1.16E-07	= [	1.99E+01	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	25,550	]
Chromium	2.93E-07	= [	5.03E+01	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	25,550	]
NONCARCINOGENIC EFFECTS																		
Carbazole	4.43E-08	= [	1.09E-01	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	365	]
Benz(a)anthracene	1.84E-06	= [	4.51E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	365	]
Benzo(a)pyrene	2.06E-06	= [	5.07E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	365	]
Benzo(b)fluoranthene	3.45E-06	= [	8.48E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	365	]
Chrysene	2.92E-06	= [	7.17E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	365	]
Dibenz(a,h)anthracene	5.98E-07	= [	1.47E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	365	]
Indeno(1,2,3-cd)pyrene	1.71E-06	= [	4.20E+00	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	365	]
Arsenic	8.09E-06	= [	1.99E+01	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	365	]
Chromium	2.05E-05	= [	5.03E+01	x	330	x	1	x	1.00E-06	x	36	x	1	] / [	80	x	365	]

$DI_{ingestion}$ = daily chemical intake via soil ingestion
CS = chemical concentration in soil
IR = soil ingestion rate
FI = fraction of intake
CF = conversion factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

Table B1.3
SMA 4, Surface Soil, 0 - 1 ft - Daily Intake Calculations: Adolscent Trespasser
Ingestion of Chemicals in Surface Soil, 0 - 1 ft depth
ERP Coke Facility, Birmingham, AL

Equation	$DI_{ingestion}$	= [	CS	x	IR	x	FI	x	CF	x	EF	x	ED	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/kg**		**mg soil/day**		**unitless**		**kg/mg**		**days/year**		**years**		**kg**		**days**	
CARCINOGENIC EFFECTS																		
Carbazole	1.09E-09	= [	1.09E-01	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Benz(a)anthracene	4.51E-08	= [	4.51E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Benzo(a)pyrene	5.07E-08	= [	5.07E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Benzo(b)fluoranthene	8.47E-08	= [	8.48E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Chrysene	7.16E-08	= [	7.17E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Dibenz(a,h)anthracene	1.47E-08	= [	1.47E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Indeno(1,2,3-cd)pyrene	4.19E-08	= [	4.20E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Naphthalene	4.43E-08	= [	4.43E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Aluminum	2.54E-04	= [	2.54E+04	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Arsenic	1.99E-07	= [	1.99E+01	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Chromium	5.03E-07	= [	5.03E+01	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Cobalt	1.29E-07	= [	1.29E+01	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Manganese	1.43E-05	= [	1.43E+03	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
Vanadium	4.49E-07	= [	4.50E+01	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	25,550	]
NONCARCINOGENIC EFFECTS																		
Carbazole	7.62E-09	= [	1.09E-01	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Benz(a)anthracene	3.16E-07	= [	4.51E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Benzo(a)pyrene	3.55E-07	= [	5.07E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Benzo(b)fluoranthene	5.93E-07	= [	8.48E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Chrysene	5.01E-07	= [	7.17E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Dibenz(a,h)anthracene	1.03E-07	= [	1.47E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Indeno(1,2,3-cd)pyrene	2.93E-07	= [	4.20E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Naphthalene	3.10E-07	= [	4.43E+00	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Aluminum	1.78E-03	= [	2.54E+04	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Arsenic	1.39E-06	= [	1.99E+01	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Chromium	3.52E-06	= [	5.03E+01	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Cobalt	9.02E-07	= [	1.29E+01	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Manganese	9.98E-05	= [	1.43E+03	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]
Vanadium	3.14E-06	= [	4.50E+01	x	100	x	1	x	1.00E-06	x	12	x	10	] / [	47	x	3,650	]

$DI_{ingestion}$ = daily chemical intake via soil ingestion
CS = chemical concentration in soil
IR = soil ingestion rate
FI = fraction of intake
CF = conversion factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

Table B1.4
SMA 4, Subsurface Soil, 2 - 15 ft, Daily Intake Calculations: Industrial/Commercial Worker
Ingestion of Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	$DI_{ingestion}$	= [	CS	x	IR	x	FI	x	CF	x	EF	x	ED	] / [	BW	x	AT	]
Units	mg/kg-day		mg/kg		mg soil/day		unitless		kg/mg		days/year		years		kg		days	
CARCINOGENIC EFFECTS																		
1,1,2-Trichloroethane	4.95E-09	= [	8.10E-01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Benzene	5.34E-07	= [	8.73E+01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Chlorobenzene	1.65E-06	= [	2.70E+02	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Ethylbenzene	1.60E-07	= [	2.61E+01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Toluene	1.68E-05	= [	2.74E+03	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Vinyl chloride	7.09E-10	= [	1.16E-01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Xylenes	1.21E-06	= [	1.99E+02	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Benzo(a)anthracene	3.31E-08	= [	5.42E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Benzo(a)pyrene	2.77E-08	= [	4.54E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Benzo(b)fluoranthene	3.84E-08	= [	6.28E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Benzo(k)fluoranthene	8.94E-09	= [	1.46E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Carbazole	1.19E-08	= [	1.95E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Chrysene	3.00E-08	= [	4.90E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Dibenzo(a,h)anthracene	2.93E-09	= [	4.79E-01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	8.44E-09	= [	1.38E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Naphthalene	4.92E-07	= [	8.05E+01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Arsenic	6.04E-08	= [	9.87E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
Chromium	2.00E-07	= [	3.27E+01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	25,550	]
NONCARCINOGENIC EFFECTS																		
1,1,2-Trichloroethane	1.39E-08	= [	8.10E-01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Benzene	1.50E-06	= [	8.73E+01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Chlorobenzene	4.63E-06	= [	2.70E+02	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Ethylbenzene	4.47E-07	= [	2.61E+01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Toluene	4.70E-05	= [	2.74E+03	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Vinyl chloride	1.99E-09	= [	1.16E-01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Xylenes	3.40E-06	= [	1.99E+02	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Benzo(a)anthracene	9.28E-08	= [	5.42E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Benzo(a)pyrene	7.77E-08	= [	4.54E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Benzo(b)fluoranthene	1.07E-07	= [	6.28E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Benzo(k)fluoranthene	2.50E-08	= [	1.46E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Carbazole	3.34E-08	= [	1.95E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Chrysene	8.40E-08	= [	4.90E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Dibenzo(a,h)anthracene	8.20E-09	= [	4.79E-01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Indeno(1,2,3-cd)pyrene	2.36E-08	= [	1.38E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Naphthalene	1.38E-06	= [	8.05E+01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Arsenic	1.69E-07	= [	9.87E+00	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]
Chromium	5.60E-07	= [	3.27E+01	x	100	x	1	x	1.00E-06	x	5	x	25	] / [	80	x	9,125	]

$DI_{ingestion}$ = daily chemical intake via soil ingestion
CS = chemical concentration in soil
IR = soil ingestion rate
FI = fraction of intake
CF = conversion factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

Table B1.5
SMA 4, Subsurface Soil, 2 - 15 ft, Daily Intake Calculations: Construction Worker
Ingestion of Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	$DI_{ingestion}$	= [	CS	x	IR	x	FI	x	CF	x	EF	x	ED	] / [	BW	x	AT	]
Units	mg/kg-day		mg/kg		mg soil/day		unitless		kg/mg		days/year		years		kg		days	
CARCINOGENIC EFFECTS																		
1,1,2-Trichloroethane	3.27E-08	= [	8.10E-01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Benzene	3.52E-06	= [	8.73E+01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Chlorobenzene	1.09E-05	= [	2.70E+02	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Ethylbenzene	1.05E-06	= [	2.61E+01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Toluene	1.11E-04	= [	2.74E+03	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Vinyl chloride	4.68E-09	= [	1.16E-01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Xylenes	8.01E-06	= [	1.99E+02	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Benzo(a)anthracene	2.19E-07	= [	5.42E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Benzo(a)pyrene	1.83E-07	= [	4.54E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Benzo(b)fluoranthene	2.53E-07	= [	6.28E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Benzo(k)fluoranthene	5.90E-08	= [	1.46E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Carbazole	7.88E-08	= [	1.95E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Chrysene	1.98E-07	= [	4.90E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Dibenzo(a,h)anthracene	1.93E-08	= [	4.79E-01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	5.57E-08	= [	1.38E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Naphthalene	3.25E-06	= [	8.05E+01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Arsenic	3.98E-07	= [	9.87E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
Chromium	1.32E-06	= [	3.27E+01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	25,550	]
NONCARCINOGENIC EFFECTS																		
1,1,2-Trichloroethane	2.29E-06	= [	8.10E-01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Benzene	2.47E-04	= [	8.73E+01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Chlorobenzene	7.64E-04	= [	2.70E+02	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Ethylbenzene	7.38E-05	= [	2.61E+01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Toluene	7.75E-03	= [	2.74E+03	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Vinyl chloride	3.28E-07	= [	1.16E-01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Xylenes	5.61E-04	= [	1.99E+02	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Benzo(a)anthracene	1.53E-05	= [	5.42E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Benzo(a)pyrene	1.28E-05	= [	4.54E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Benzo(b)fluoranthene	1.77E-05	= [	6.28E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Benzo(k)fluoranthene	4.13E-06	= [	1.46E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Carbazole	5.52E-06	= [	1.95E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Chrysene	1.39E-05	= [	4.90E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Dibenzo(a,h)anthracene	1.35E-06	= [	4.79E-01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Indeno(1,2,3-cd)pyrene	3.90E-06	= [	1.38E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Naphthalene	2.27E-04	= [	8.05E+01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Arsenic	2.79E-05	= [	9.87E+00	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]
Chromium	9.24E-05	= [	3.27E+01	x	330	x	1	x	1.00E-06	x	250	x	1	] / [	80	x	365	]

$DI_{ingestion}$ = daily chemical intake via soil ingestion
CS = chemical concentration in soil
IR = soil ingestion rate
FI = fraction of intake
CF = conversion factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

Table B1.6
SMA 4, Mineral Wool Pile - Daily Intake Calculations: Industrial/Commercial Worker
Ingestion of Chemicals
ERP Coke Facility, Birmingham, AL

Equation	$DI_{ingestion}$	= [	CS	x	IR	x	FI	x	CF	x	EF	x	ED	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/kg**		**mg SWA/day**		**unitless**		**kg/mg**		**days/year**		**years**		**kg**		**days**	
CARCINOGENIC EFFECTS																		
Benzo(a)pyrene	4.58E-09	= [	1.04E-01	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	25,550	]
Benzo(a)anthracene	4.45E-09	= [	1.01E-01	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	25,550	]
Benzo(b)fluoranthene	3.58E-09	= [	8.12E-02	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	25,550	]
Chrysene	3.87E-09	= [	8.78E-02	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	25,550	]
Dibenz(a,h)anthracene	2.86E-09	= [	6.50E-02	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	1.52E-09	= [	3.45E-02	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	25,550	]
Carbazole	8.37E-10	= [	1.90E-02	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	25,550	]
Arsenic	1.06E-07	= [	2.42E+00	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	25,550	]
Chromium	1.52E-06	= [	3.46E+01	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	25,550	]
NONCARCINOGENIC EFFECTS																		
Benzo(a)pyrene	1.28E-08	= [	1.04E-01	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	9,125	]
Benzo(a)anthracene	1.25E-08	= [	1.01E-01	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	9,125	]
Benzo(b)fluoranthene	1.00E-08	= [	8.12E-02	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	9,125	]
Chrysene	1.08E-08	= [	8.78E-02	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	9,125	]
Dibenz(a,h)anthracene	8.01E-09	= [	6.50E-02	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	9,125	]
Indeno(1,2,3-cd)pyrene	4.25E-09	= [	3.45E-02	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	9,125	]
Carbazole	2.34E-09	= [	1.90E-02	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	9,125	]
Arsenic	2.98E-07	= [	2.42E+00	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	9,125	]
Chromium	4.26E-06	= [	3.46E+01	x	100	x	1	x	1.00E-06	x	36	x	25	] / [	80	x	9,125	]

SWA = slag wool aggregate
DIingestion = daily chemical intake via mineral wool ingestion
CS = chemical concentration in mineral wool
IR = mineral wool ingestion rate
FI = fraction of intake
CF = conversion factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

Table B1.7
SMA 4, Surface Soil, 0 - 1 ft, Kd Calculations
ERP Coke Facility, Birmingham, AL

Chemical	Koc cm^3/g	x	foc	=	Kd cm^3/g
Workers					
Carbazole	nd	x	0.006	=	na
Benz(a)anthracene	1.77E+05	x	0.006	=	1.06E+03
Benzo(a)pyrene	5.87E+05	x	0.006	=	3.52E+03
Benzo(b)fluoranthene	5.99E+05	x	0.006	=	3.60E+03
Chrysene	1.81E+05	x	0.006	=	1.08E+03
Dibenz(a,h)anthracene	1.91E+06	x	0.006	=	1.15E+04
Indeno(1,2,3-cd)pyrene	1.95E+06	x	0.006	=	1.17E+04
Arsenic	nd	x	0.006	=	na
Chromium	nd	x	0.006	=	na
Trespassers					
Carbazole	nd	x	0.006	=	na
Benz(a)anthracene	1.77E+05	x	0.006	=	1.06E+03
Benzo(a)pyrene	5.87E+05	x	0.006	=	3.52E+03
Benzo(b)fluoranthene	5.99E+05	x	0.006	=	3.60E+03
Chrysene	1.81E+05	x	0.006	=	1.08E+03
Dibenz(a,h)anthracene	1.91E+06	x	0.006	=	1.15E+04
Indeno(1,2,3-cd)pyrene	1.95E+06	x	0.006	=	1.17E+04
Naphthalene	1.54E+03	x	0.006	=	9.26E+00
Aluminum	nd	x	0.006	=	na
Arsenic	nd	x	0.006	=	na
Chromium	nd	x	0.006	=	na
Cobalt	nd	x	0.006	=	na
Manganese	nd	x	0.006	=	na
Vanadium	nd	x	0.006	=	na

K_{OC} = soil organic carbon partition coefficient, chemical specific

Source for K_{OC} = USEPA RSL Table, November 2015

f_{OC} = fraction organic carbon in soil (g/g), 0.006

K_d = soil-water partition coefficient = K_{OC} x f_{OC}, chemical specific

nd = no data

na = not applicable

Table B1.8
SMA 4, Subsurface Soil, 2 - 15 ft, Kd Calculations
ERP Coke Facility, Birmingham, AL

Chemical	Koc	x	foc	=	Kd
1,1,2-Trichloroethane	6.07E+01	x	0.006	=	3.64E-01
Benzene	1.46E+02	x	0.006	=	8.75E-01
Chlorobenzene	2.34E+02	x	0.006	=	1.40E+00
Ethylbenzene	4.46E+02	x	0.006	=	2.68E+00
Toluene	2.34E+02	x	0.006	=	1.40E+00
Vinyl chloride	2.17E+01	x	0.006	=	1.30E-01
Xylenes	3.83E+02	x	0.006	=	2.30E+00
Benzo(a)anthracene	1.77E+05	x	0.006	=	1.06E+03
Benzo(a)pyrene	5.87E+05	x	0.006	=	3.52E+03
Benzo(b)fluoranthene	5.99E+05	x	0.006	=	3.60E+03
Benzo(k)fluoranthene	5.87E+05	x	0.006	=	3.52E+03
Carbazole	nd	x	0.006	=	na
Chrysene	1.81E+05	x	0.006	=	1.08E+03
Dibenzo(a,h)anthracene	1.91E+06	x	0.006	=	1.15E+04
Indeno(1,2,3-cd)pyrene	1.95E+06	x	0.006	=	1.17E+04
Naphthalene	1.54E+03	x	0.006	=	9.26E+00
Arsenic	nd	x	0.006	=	na
Chromium	nd	x	0.006	=	na

K_{OC} = soil organic carbon partition coefficient (cm^3 / g), chemical specific
USEPA RSL Table, November 2015.

f_{OC} = fraction organic carbon in soil (g/g), 0.006

K_d = soil-water partition coefficient (cm^3/g) = K_{OC} x f_{OC}, chemical specific

nd = no data available for this chemical

na = not applicable

Table B1.9
SMA 4, Mineral Wool Pile - Kd Calculations
ERP Coke Facility, Birmingham, AL

Chemical	Koc	x	foc	=	Kd
Benzo(a)pyrene	5.87E+05	x	0.006	=	3.52E+03
Benzo(a)anthracene	1.77E+05	x	0.006	=	1.06E+03
Benzo(b)fluoranthene	5.99E+05	x	0.006	=	3.60E+03
Chrysene	1.81E+05	x	0.006	=	1.08E+03
Dibenz(a,h)anthracene	1.91E+06	x	0.006	=	1.15E+04
Indeno(1,2,3-cd)pyrene	1.95E+06	x	0.006	=	1.17E+04
Carbazole	nd	x	0.006	=	na
Arsenic	nd	x	0.006	=	na
Chromium	nd	x	0.006	=	na

KOC = soil organic carbon partition coefficient (cm3 / g), chemical specific
USEPA RSL Table, November 2015.

foc = fraction organic carbon in soil (g/g), 0.006

Kd = soil-water partition coefficient (cm3/g) = KOC x fOC, chemical specific

nd = no data

na = not applicable

Table B1.10
SMA 4, Surface Soil, 0 - 1 ft - Derivation of Dispersion Factors
ERP Coke Facility, Birmingham, AL

Equation	Q/C	=	A	x exp [(ln	A_{site}	-	B	)^2 /	C	]
Units	**g/m^2-s per kg/m^3**		**unitless**		**ac**		**unitless**		**unitless**	
SMA 4	90.70	=	14.835	x exp [(ln	0.28	-	17.953	)^2 /	204.152	]

Source: USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* Office of Solid Waste and Emergency Response, OSWER 9355.4-24. Washington, DC.

Q/C = inverse of mean concentration at center of source (g/m^2-s per kg/m^3).
Constants A, B, and C based on Zone 6, Atlanta, GA
A_{site} = approx. 0.28 acres, this area is 3 ft wide by 4,000 ft long

Table B1.11
SMA 4, Subsurface Soil, 2 - 15 ft, Derivation of Dispersion Factors
ERP Coke Facility, Birmingham, AL

Equation	Q/C	=	A	x exp [(ln	A_{site}	-	B	)^2 /	C	]
Units	**g/m^2-s per kg/m^3**		**unitless**		**ac**		**unitless**		**unitless**	
SMA 4	42.49	=	14.835	x exp [(ln	27	-	17.953	)^2 /	204.152	]

Source: USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* Office of Solid Waste and Emergency Response, OSWER 9355.4-24. Washington, DC.

Q/C = inverse of mean concentration at center of source (g/m^2-s per kg/m^3).
Constants A, B, and C based on Zone 6, Atlanta, GA
A_{site} = approx. 27 acres

Table B1.12
SMA 4, Mineral Wool Pile, Derivation of Dispersion Factors
ERP Coke Facility, Birmingham, AL

Equation	Q/C	=	A	x exp [(ln	A_{site}	-	B	)^2 /	C	]
Units	**g/m^2-s per kg/m^3**		**unitless**		**ac**		**unitless**		**unitless**	
SMA 4	90.28	=	14.835	x exp [(ln	0.287	-	17.953	)^2 /	204.152	]

Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for *Superfund Sites.* Office of Solid Waste and Emergency Response, OSWER 9355.4-24. Washington, DC.

Q/C = inverse of mean concentration at center of source (g/m^2-s per kg/m^3).
Constants A, B, and C based on Zone 6, Atlanta, GA
A_{site} = approx. 50 x 250 ft, 0.287 acres

Table B1.13
SMA 4, Surface Soil, 0 - 1 ft - Apparent Diffusivity, DA
ERP Coke Facility, Birmingham, AL

Equation:	DA	=	[	(	$\theta_a^{10/3}$	x	D_i	x	H'	)	+	(	$\theta_w^{10/3}$	x	D_w	)	/	n^2	]	/	[	(	ρ_b	x	K_d	)	+	θ_w	+	(	θ_a	x	H'	)	]
Units:	cm^2/sec				L_{air}/L_{soil}		cm^2/sec		unitless				m^3/kg		cm^2/sec			unitless					g/cm^3										unitless		
Workers																																		
Carbazole	na	=	[	(	1.5E-02	x	nd	x	nd	)	+	(	0.00179	x	nd	)	/	0.1884	]	/	[	(	1.5	x	na	)	+	0.2	+	(	0.28	x	nd	)	]
Benz(a)anthracene	1.61E-10	=	[	(	1.5E-02	x	2.6E-02	x	4.9E-04	)	+	(	0.00179	x	6.7E-06	)	/	0.1884	]	/	[	(	1.5	x	1.06E+03	)	+	0.2	+	(	0.28	x	4.9E-04	)	]
Benzo(a)pyrene	1.25E-11	=	[	(	1.5E-02	x	4.8E-02	x	1.9E-05	)	+	(	0.00179	x	5.6E-06	)	/	0.1884	]	/	[	(	1.5	x	3.52E+03	)	+	0.2	+	(	0.28	x	1.9E-05	)	]
Benzo(b)fluoranthene	1.34E-11	=	[	(	1.5E-02	x	4.8E-02	x	2.7E-05	)	+	(	0.00179	x	5.6E-06	)	/	0.1884	]	/	[	(	1.5	x	3.60E+03	)	+	0.2	+	(	0.28	x	2.7E-05	)	]
Chrysene	9.10E-11	=	[	(	1.5E-02	x	2.6E-02	x	2.1E-04	)	+	(	0.00179	x	6.7E-06	)	/	0.1884	]	/	[	(	1.5	x	1.08E+03	)	+	0.2	+	(	0.28	x	2.1E-04	)	]
Dibenz(a,h)anthracene	3.10E-12	=	[	(	1.5E-02	x	4.5E-02	x	5.8E-06	)	+	(	0.00179	x	5.2E-06	)	/	0.1884	]	/	[	(	1.5	x	1.15E+04	)	+	0.2	+	(	0.28	x	5.8E-06	)	]
Indeno(1,2,3-cd)pyrene	3.38E-12	=	[	(	1.5E-02	x	4.5E-02	x	1.4E-05	)	+	(	0.00179	x	5.2E-06	)	/	0.1884	]	/	[	(	1.5	x	1.17E+04	)	+	0.2	+	(	0.28	x	1.4E-05	)	]
Arsenic	na	=	[	(	1.5E-02	x	nd	x	nd	)	+	(	0.00179	x	nd	)	/	0.1884	]	/	[	(	1.5	x	na	)	+	0.2	+	(	0.28	x	nd	)	]
Chromium	na	=	[	(	1.5E-02	x	nd	x	nd	)	+	(	0.00179	x	nd	)	/	0.1884	]	/	[	(	1.5	x	na	)	+	0.2	+	(	0.28	x	nd	)	]
Trespassers																																		
Carbazole	na	=	[	(	1.5E-02	x	nd	x	nd	)	+	(	0.00179	x	nd	)	/	0.1884	]	/	[	(	1.5	x	na	)	+	0.2	+	(	0.28	x	nd	)	]
Benz(a)anthracene	1.61E-10	=	[	(	1.5E-02	x	2.6E-02	x	4.9E-04	)	+	(	0.00179	x	6.7E-06	)	/	0.1884	]	/	[	(	1.5	x	1.06E+03	)	+	0.2	+	(	0.28	x	4.9E-04	)	]
Benzo(a)pyrene	1.25E-11	=	[	(	1.5E-02	x	4.8E-02	x	1.9E-05	)	+	(	0.00179	x	5.6E-06	)	/	0.1884	]	/	[	(	1.5	x	3.52E+03	)	+	0.2	+	(	0.28	x	1.9E-05	)	]
Benzo(b)fluoranthene	1.34E-11	=	[	(	1.5E-02	x	4.8E-02	x	2.7E-05	)	+	(	0.00179	x	5.6E-06	)	/	0.1884	]	/	[	(	1.5	x	3.60E+03	)	+	0.2	+	(	0.28	x	2.7E-05	)	]
Chrysene	9.10E-11	=	[	(	1.5E-02	x	2.6E-02	x	2.1E-04	)	+	(	0.00179	x	6.7E-06	)	/	0.1884	]	/	[	(	1.5	x	1.08E+03	)	+	0.2	+	(	0.28	x	2.1E-04	)	]
Dibenz(a,h)anthracene	3.10E-12	=	[	(	1.5E-02	x	4.5E-02	x	5.8E-06	)	+	(	0.00179	x	5.2E-06	)	/	0.1884	]	/	[	(	1.5	x	1.15E+04	)	+	0.2	+	(	0.28	x	5.8E-06	)	]
Indeno(1,2,3-cd)pyrene	3.38E-12	=	[	(	1.5E-02	x	4.5E-02	x	1.4E-05	)	+	(	0.00179	x	5.2E-06	)	/	0.1884	]	/	[	(	1.5	x	1.17E+04	)	+	0.2	+	(	0.28	x	1.4E-05	)	]
Naphthalene	1.17E-06	=	[	(	1.5E-02	x	6.0E-02	x	1.8E-02	)	+	(	0.00179	x	8.4E-06	)	/	0.1884	]	/	[	(	1.5	x	9.26E+00	)	+	0.2	+	(	0.28	x	1.8E-02	)	]
Aluminum	na	=	[	(	1.5E-02	x	nd	x	nd	)	+	(	0.00179	x	nd	)	/	0.1884	]	/	[	(	1.5	x	na	)	+	0.2	+	(	0.28	x	nd	)	]
Arsenic	na	=	[	(	1.5E-02	x	nd	x	nd	)	+	(	0.00179	x	nd	)	/	0.1884	]	/	[	(	1.5	x	na	)	+	0.2	+	(	0.28	x	nd	)	]
Chromium	na	=	[	(	1.5E-02	x	nd	x	nd	)	+	(	0.00179	x	nd	)	/	0.1884	]	/	[	(	1.5	x	na	)	+	0.2	+	(	0.28	x	nd	)	]
Cobalt	na	=	[	(	1.5E-02	x	nd	x	nd	)	+	(	0.00179	x	nd	)	/	0.1884	]	/	[	(	1.5	x	na	)	+	0.2	+	(	0.28	x	nd	)	]
Manganese	na	=	[	(	1.5E-02	x	nd	x	nd	)	+	(	0.00179	x	nd	)	/	0.1884	]	/	[	(	1.5	x	na	)	+	0.2	+	(	0.28	x	nd	)	]
Vanadium	na	=	[	(	1.5E-02	x	nd	x	nd	)	+	(	0.00179	x	nd	)	/	0.1884	]	/	[	(	1.5	x	na	)	+	0.2	+	(	0.28	x	nd	)	]

Equation Source: USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* Office of Solid Waste and Emergency Response, OSWER 9355.4-24.
Parameters Source: USEPA RSL Parameter Table, November 2015

DA = apparent diffusivity
θ_a = air filled porosity (L_{air}/L_{soil}) = n - θ_w = 0.284
θ_w = water-filled porosity (L_{water}/L_{soil}) = 0.15
n = total soil porosity (L_{pore}/L_{soil}) = 1 - (ρ_b/ρ_s) = 0.434
ρ_b = dry soil bulk density (g/cm^3) = 1.5 g/cm^3
ρ_s = soil particle density (g/cm^3) = 2.65 g/cm^3

D_i = diffusivity in air (cm^2/sec), chemical specific
H' = Henrys law constant, unitless, chemical specific
D_w = diffusivity in water (cm^2/sec), chemical specific
K_d = soil-water partition coefficient, (cm^3/g) = K_{OC} x f_{OC}, chemical specific
K_{OC} = soil organic carbon partition coefficient (cm^3 / g), chemical specific
f_{OC} = fraction organic carbon in soil (g/g), 0.006

nd = no data
na = not applicable

Table B1.14
SMA 4, Subsurface Soil, 2 - 15 ft - Apparent Diffusivity - DA
ERP Coke Facility, Birmingham, AL

Equation:	DA	= [(	$\theta_a^{10/3}$	x	D_i	x	H'	) + (	$\theta_w^{10/3}$	x	D_w	) /	n^2	] / [(	ρ_b	x	K_d	) +	θ_w	+ (	θ_a	x	H'	)]
Units:	cm^2/sec		L_{air}/L_{soil}		cm^2/sec		unitless		m^3/kg		cm^2/sec		unitless		g/cm^3								unitless	
1,1,2-Trichloroethane	4.80E-05	= [(	1.50E-02	x	0.06689	x	0.0336877	) + (	0.00179	x	0.00001	) /	0.1884	] / [(	1.5	x	3.64E-01	) +	0.2	+ (	0.28	x	0.0336877	)]
Benzene	2.00E-04	= [(	1.50E-02	x	0.089534	x	0.2269011	) + (	0.00179	x	0.0000103	) /	0.1884	] / [(	1.5	x	8.75E-01	) +	0.2	+ (	0.28	x	0.2269011	)]
Chlorobenzene	6.01E-05	= [(	1.50E-02	x	0.072131	x	0.1271464	) + (	0.00179	x	9.4765E-06	) /	0.1884	] / [(	1.5	x	1.40E+00	) +	0.2	+ (	0.28	x	0.1271464	)]
Ethylbenzene	7.77E-05	= [(	1.50E-02	x	0.068465	x	0.3221586	) + (	0.00179	x	8.4558E-06	) /	0.1884	] / [(	1.5	x	2.68E+00	) +	0.2	+ (	0.28	x	0.3221586	)]
Toluene	1.36E-04	= [(	1.50E-02	x	0.077804	x	0.2714636	) + (	0.00179	x	9.2043E-06	) /	0.1884	] / [(	1.5	x	1.40E+00	) +	0.2	+ (	0.28	x	0.2714636	)]
Vinyl chloride	2.73E-03	= [(	1.50E-02	x	0.10712	x	1.1365495	) + (	0.00179	x	0.000012	) /	0.1884	] / [(	1.5	x	1.30E-01	) +	0.2	+ (	0.28	x	1.1365495	)]
Xylenes	7.59E-05	= [(	1.50E-02	x	0.068515	x	0.2710548	) + (	0.00179	x	8.4641E-06	) /	0.1884	] / [(	1.5	x	2.30E+00	) +	0.2	+ (	0.28	x	0.2710548	)]
Benzo(a)anthracene	1.61E-10	= [(	1.50E-02	x	0.026114	x	0.0004906	) + (	0.00179	x	6.7495E-06	) /	0.1884	] / [(	1.5	x	1.06E+03	) +	0.2	+ (	0.28	x	0.0004906	)]
Benzo(a)pyrene	1.25E-11	= [(	1.50E-02	x	0.047583	x	0.0000187	) + (	0.00179	x	5.5597E-06	) /	0.1884	] / [(	1.5	x	3.52E+03	) +	0.2	+ (	0.28	x	0.0000187	)]
Benzo(b)fluoranthene	1.34E-11	= [(	1.50E-02	x	0.047583	x	0.0000269	) + (	0.00179	x	5.5597E-06	) /	0.1884	] / [(	1.5	x	3.60E+03	) +	0.2	+ (	0.28	x	0.0000269	)]
Benzo(k)fluoranthene	1.32E-11	= [(	1.50E-02	x	0.047583	x	0.0000239	) + (	0.00179	x	5.5597E-06	) /	0.1884	] / [(	1.5	x	3.52E+03	) +	0.2	+ (	0.28	x	0.0000239	)]
Carbazole	na	= [(	1.50E-02	x	nd	x	nd	) + (	0.00179	x	nd	) /	0.1884	] / [(	1.5	x	na	) +	0.2	+ (	0.28	x	nd	)]
Chrysene	9.10E-11	= [(	1.50E-02	x	0.026114	x	0.0002138	) + (	0.00179	x	6.7495E-06	) /	0.1884	] / [(	1.5	x	1.08E+03	) +	0.2	+ (	0.28	x	0.0002138	)]
Dibenzo(a,h)anthracene	3.10E-12	= [(	1.50E-02	x	0.044567	x	5.765E-06	) + (	0.00179	x	5.2073E-06	) /	0.1884	] / [(	1.5	x	1.15E+04	) +	0.2	+ (	0.28	x	0.0000058	)]
Indeno(1,2,3-cd)pyrene	3.38E-12	= [(	1.50E-02	x	0.044784	x	0.0000142	) + (	0.00179	x	5.2327E-06	) /	0.1884	] / [(	1.5	x	1.17E+04	) +	0.2	+ (	0.28	x	0.0000142	)]
Naphthalene	1.17E-06	= [(	1.50E-02	x	0.060499	x	0.0179886	) + (	0.00179	x	8.377E-06	) /	0.1884	] / [(	1.5	x	9.26E+00	) +	0.2	+ (	0.28	x	0.0179886	)]
Arsenic	na	= [(	1.50E-02	x	nd	x	nd	) + (	0.00179	x	nd	) /	0.1884	] / [(	1.5	x	na	) +	0.2	+ (	0.28	x	nd	)]
Chromium	na	= [(	1.50E-02	x	nd	x	nd	) + (	0.00179	x	nd	) /	0.1884	] / [(	1.5	x	na	) +	0.2	+ (	0.28	x	nd	)]

Equation Source: USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* Office of Solid Waste and Emergency Response, OSWER 9355.4-24.
Parameters Source: USEPA RSLs, Parameters Table, November 2015

DA = apparent diffusivity

$\theta_a^{10/3}$ = air filled porosity (L_{air}/L_{soil}) = $[n - \theta_w]^{10/3} = [0.284]^{10/3} = 0.015$

$\theta_w^{10/3}$ = water-filled porosity (L_{water}/L_{soil}) = $[0.15]^{10/3} = 0.00179$

n^2 = total soil porosity (L_{pore}/L_{soil}) = $[1 - (\rho_b/\rho_s)]^2 = [0.434]^2 = 0.1884$

ρ_b = dry soil bulk density (g/cm^3) = 1.5 g/cm^3

ρ_s = soil particle density (g/cm^3) = 2.65 g/cm^3

D_i = diffusivity in air (cm^2/sec), chemical specific

H' = Henrys law constant, unitless, chemical specific

D_w = diffusivity in water (cm^2/sec), chemical specific

K_d = soil-water partition coefficient, cm^3/g) = K_{OC} x f_{OC}, chemical specific

K_{OC} = soil organic carbon partition coefficient (cm^3 / g), chemical specific

f_{OC} = fraction organic carbon in soil (g/g), 0.006

Table B1.15
SMA 4, Mineral Wool Pile, Apparent Diffusivity - DA
ERP Coke Facility, Birmingham, AL

Equation:	DA	= [(	$\theta_a^{10/3}$	x	D_i	x	H'	) + (	$\theta_w^{10/3}$	x	D_w	) /	n^2	] / [(	ρ_b	x	K_d	) +	θ_w	+ (	θ_a	x	H'	)]
Units:	cm^2/sec		Lair/Lsoil		cm^2/sec		unitless		m^3/kg		cm^2/sec		unitless		g/cm^3								unitless	
Benzo(a)pyrene	1.25E-11	= [(	1.50E-02	x	0.047583	x	0.0000187	) + (	0.00179	x	5.56E-06	) /	0.1884	] / [(	1.5	x	3.52E+03	) +	0.2	+ (	0.28	x	0.0000187	)]
Benzo(a)anthracene	1.61E-10	= [(	1.50E-02	x	0.026114	x	0.0004906	) + (	0.00179	x	6.75E-06	) /	0.1884	] / [(	1.5	x	1.06E+03	) +	0.2	+ (	0.28	x	0.0004906	)]
Benzo(b)fluoranthene	1.34E-11	= [(	1.50E-02	x	0.047583	x	0.0000269	) + (	0.00179	x	5.56E-06	) /	0.1884	] / [(	1.5	x	3.60E+03	) +	0.2	+ (	0.28	x	0.0000269	)]
Chrysene	9.10E-11	= [(	1.50E-02	x	0.026114	x	0.0002138	) + (	0.00179	x	6.75E-06	) /	0.1884	] / [(	1.5	x	1.08E+03	) +	0.2	+ (	0.28	x	0.0002138	)]
Dibenz(a,h)anthracene	3.10E-12	= [(	1.50E-02	x	0.044567	x	5.765E-06	) + (	0.00179	x	5.207E-06	) /	0.1884	] / [(	1.5	x	1.15E+04	) +	0.2	+ (	0.28	x	0.0000058	)]
Indeno(1,2,3-cd)pyrene	3.38E-12	= [(	1.50E-02	x	0.044784	x	0.0000142	) + (	0.00179	x	5.233E-06	) /	0.1884	] / [(	1.5	x	1.17E+04	) +	0.2	+ (	0.28	x	0.0000142	)]
Carbazole	na	= [(	1.50E-02	x	nd	x	nd	) + (	0.00179	x	nd	) /	0.1884	] / [(	1.5	x	na	) +	0.2	+ (	0.28	x	nd	)]
Arsenic	na	= [(	1.50E-02	x	nd	x	nd	) + (	0.00179	x	nd	) /	0.1884	] / [(	1.5	x	na	) +	0.2	+ (	0.28	x	nd	)]
Chromium	na	= [(	1.50E-02	x	nd	x	nd	) + (	0.00179	x	nd	) /	0.1884	] / [(	1.5	x	na	) +	0.2	+ (	0.28	x	nd	)]

Equation Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response, OSWER 9355.4-24.
Parameters Source: USEPA RSL Parameters Table, November 2015.

na = not applicable
nd = no data

DA = apparent diffusivity
θa10/3 = air filled porosity (Lair/Lsoil) = [n - θw]10/3 = [0.284]10/3 = 0.015
θw10/3 = water-filled porosity (Lwater/Lsoil) = [0.15]10/3 = 0.00179
n2 = total soil porosity (Lpore/Lsoil) = [1 - (ρb/ρs)]2 = [0.434]2 = 0.1884
ρb = dry soil bulk density (g/cm3) = 1.5 g/cm3
ρs = soil particle density (g/cm3) = 2.65 g/cm3

D_i = diffusivity in air (cm^2/sec), chemical specific
H' = Henrys law constant, unitless, chemical specific
D_w = diffusivity in water (cm^2/sec), chemical specific
Kd = soil-water partition coefficient, cm3/g) = KOC x fOC, chemical specific
KOC = soil organic carbon partition coefficient (cm3 / g), chemical specific
fOC = fraction organic carbon in soil (g/g), 0.006

Table B1.16
SMA 4, Surface Soil 0 - 1 ft - Volatilization Factor Calculations[(1)] - VF
ERP Coke Facility, Birmingham, AL

Equation: VF = [Q/C x (3.14 x D_A x T)$^{1/2}$ x CF] / (2 x ρ_b x D_A)																				
Units:	m^3/kg		g/m^2-s per kg/m^3				cm^2/sec		sec										cm^2/sec	
Workers																				
Carbazole	na	= [	90.70	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)
Benz(a)anthracene	1.30E+07	= [	90.70	x (	3.14	x	1.61E-10	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.61E-10	)
Benzo(a)pyrene	4.67E+07	= [	90.70	x (	3.14	x	1.25E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.25E-11	)
Benzo(b)fluoranthene	4.52E+07	= [	90.70	x (	3.14	x	1.34E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.34E-11	)
Chrysene	1.73E+07	= [	90.70	x (	3.14	x	9.10E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	9.10E-11	)
Dibenz(a,h)anthracene	9.38E+07	= [	90.70	x (	3.14	x	3.10E-12	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	3.10E-12	)
Indeno(1,2,3-cd)pyrene	8.99E+07	= [	90.70	x (	3.14	x	3.38E-12	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	3.38E-12	)
Arsenic	na	= [	90.70	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)
Chromium	na	= [	90.70	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)
Trespassers																				
Carbazole	na	= [	90.70	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)
Benz(a)anthracene	1.30E+07	= [	90.70	x (	3.14	x	1.61E-10	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.61E-10	)
Benzo(a)pyrene	4.67E+07	= [	90.70	x (	3.14	x	1.25E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.25E-11	)
Benzo(b)fluoranthene	4.52E+07	= [	90.70	x (	3.14	x	1.34E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.34E-11	)
Chrysene	1.73E+07	= [	90.70	x (	3.14	x	9.10E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	9.10E-11	)
Dibenz(a,h)anthracene	9.38E+07	= [	90.70	x (	3.14	x	3.10E-12	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	3.10E-12	)
Indeno(1,2,3-cd)pyrene	8.99E+07	= [	90.70	x (	3.14	x	3.38E-12	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	3.38E-12	)
Naphthalene	1.53E+05	= [	90.70	x (	3.14	x	1.17E-06	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.17E-06	)
Aluminum	nd	= [	90.70	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)
Arsenic	na	= [	90.70	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)
Chromium	na	= [	90.70	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)
Cobalt	na	= [	90.70	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)
Manganese	na	= [	90.70	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)
Vanadium	na	= [	90.70	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)

Source: USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* Office of Solid Waste and Emergency Response, OSWER 9355.4-24. Washington, DC.

Q/C = inverse of mean concentration at center of source (g/m2-s per kg/m3).

D_A = apparent diffusivity (cm^2/sec)

T = exposure interval (sec)

CF = conversion factor, 10^{-4} m^2/cm^2

VF = volatilazation factor

ρ_b = dry soil bulk density (g/cm^3) = 1.5 g/cm^3

na = not applicable

Table B1.17
SMA 4, Subsurface Soil, 2 - 15 ft, Volatilization Factor Calculations[1] - VF
ERP Coke Facility, Birmingham, AL

Equation:	VF	= [	Q/C	x (	3.14	x	D_A	x	T	)$^{1/2}$	x	CF	] / (	2	x	ρ_b	x	D_A	)
Units:	m^3/kg		g/m^2-s per kg/m^3				cm^2/sec		sec									cm^2/sec	
1,1,2-Trichloroethane	1.12E+04	= [	42.49	x (	3.14	x	4.80E-05	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	4.80E-05	)
Benzene	5.47E+03	= [	42.49	x (	3.14	x	2.00E-04	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	2.00E-04	)
Chlorobenzene	9.98E+03	= [	42.49	x (	3.14	x	6.01E-05	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	6.01E-05	)
Ethylbenzene	8.77E+03	= [	42.49	x (	3.14	x	7.77E-05	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	7.77E-05	)
Toluene	6.64E+03	= [	42.49	x (	3.14	x	1.36E-04	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.36E-04	)
Vinyl chloride	1.48E+03	= [	42.49	x (	3.14	x	2.73E-03	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	2.73E-03	)
Xylenes	8.88E+03	= [	42.49	x (	3.14	x	7.59E-05	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	7.59E-05	)
Benzo(a)anthracene	6.10E+06	= [	42.49	x (	3.14	x	1.61E-10	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.61E-10	)
Benzo(a)pyrene	2.19E+07	= [	42.49	x (	3.14	x	1.25E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.25E-11	)
Benzo(b)fluoranthene	2.12E+07	= [	42.49	x (	3.14	x	1.34E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.34E-11	)
Benzo(k)fluoranthene	2.13E+07	= [	42.49	x (	3.14	x	1.32E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.32E-11	)
Carbazole	na	= [	42.49	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)
Chrysene	8.11E+06	= [	42.49	x (	3.14	x	9.10E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	9.10E-11	)
Dibenzo(a,h)anthracene	4.39E+07	= [	42.49	x (	3.14	x	3.10E-12	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	3.10E-12	)
Indeno(1,2,3-cd)pyrene	4.21E+07	= [	42.49	x (	3.14	x	3.38E-12	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	3.38E-12	)
Naphthalene	7.16E+04	= [	42.49	x (	3.14	x	1.17E-06	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	1.17E-06	)
Arsenic	na	= [	42.49	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)
Chromium	na	= [	42.49	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	2	x	na	)

Source: USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* Office of Solid Waste and Emergency Response, OSWER 9355.4-24. Washington, DC.

Q/C = inverse of mean concentration at center of source (g/m2-s per kg/m3).

D_A = apparent diffusivity (cm^2/sec)

T = exposure interval (sec)

CF = conversion factor, 10^{-4} m^2/cm^2

VF = volatilazation factor

ρ_b = dry soil bulk density (g/cm^3) = 1.5 g/cm^3

Table B1.18
SMA 4, Mineral Wool Pile, Volatilization Factor Calculations - VF
ERP Coke Facility, Birmingham, AL

Equation:	VF	= [	Q/C	x (	3.14	x	D_A	x	T	)$^{1/2}$	x	CF	] / (	2	x	ρ_b	x	D_A	)
Units:	m^3/kg		g/m^2-s per kg/m^3				cm^2/sec		sec									cm^2/sec	
Benzo(a)pyrene	4.65E+07	= [	90.28	x (	3.14	x	1.25E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	1.5	x	1.25E-11	)
Benzo(a)anthracene	1.30E+07	= [	90.28	x (	3.14	x	1.61E-10	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	1.5	x	1.61E-10	)
Benzo(b)fluoranthene	4.50E+07	= [	90.28	x (	3.14	x	1.34E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	1.5	x	1.34E-11	)
Chrysene	1.72E+07	= [	90.28	x (	3.14	x	9.10E-11	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	1.5	x	9.10E-11	)
Dibenz(a,h)anthracene	9.34E+07	= [	90.28	x (	3.14	x	3.10E-12	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	1.5	x	3.10E-12	)
Indeno(1,2,3-cd)pyrene	8.95E+07	= [	90.28	x (	3.14	x	3.38E-12	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	1.5	x	3.38E-12	)
Carbazole	na	= [	90.28	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	1.5	x	na	)
Arsenic	na	= [	90.28	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	1.5	x	na	)
Chromium	na	= [	90.28	x (	3.14	x	na	x	9.50E+08	)$^{1/2}$	x	1.00E-04	] / (	2	x	1.5	x	na	)

Source: USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* Office of Solid Waste and Emergency Response, OSWER 9355.4-24. Washington, DC. na = not applicable

Q/C = inverse of mean concentration at center of source (g/m2-s per kg/m3).

D_A = apparent diffusivity (cm^2/sec)

T = exposure interval (sec) for 30 years

CF = conversion factor, 10^{-4} m^2/cm^2

VF = volatilazation factor

ρ_b = dry soil bulk density (g/cm^3) = 1.5 g/cm^3

Table B1.19
SMA 4, Surface Soil, 0 - 1 ft - Chemical Concentrations in Air Calculations
ERP Coke Facility, Birmingham, AL

Equation	CA	=	CS	x	CF	x	[(1 /	PEF	) + (1 /	VF	)]
Units	µg/m^3		mg/kg		µg/mg			m^3/kg		m^3/kg	
Workers											
Carbazole	1.91E-08	=	1.09E-01	x	1000	x	[(1 /	5.70E+09	) + (1 /	na	)]
Benz(a)anthracene	3.48E-04	=	4.51E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	1.30E+07	)]
Benzo(a)pyrene	1.10E-04	=	5.07E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	4.67E+07	)]
Benzo(b)fluoranthene	1.89E-04	=	8.48E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	4.52E+07	)]
Chrysene	4.15E-04	=	7.17E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	1.73E+07	)]
Dibenz(a,h)anthracene	1.59E-05	=	1.47E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	9.38E+07	)]
Indeno(1,2,3-cd)pyrene	4.74E-05	=	4.20E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	8.99E+07	)]
Arsenic	3.49E-06	=	1.99E+01	x	1000	x	[(1 /	5.70E+09	) + (1 /	na	)]
Chromium	8.83E-06	=	5.03E+01	x	1000	x	[(1 /	5.70E+09	) + (1 /	na	)]
Trespassers											
Carbazole	1.91E-08	=	1.09E-01	x	1000	x	[(1 /	5.70E+09	) + (1 /	na	)]
Benz(a)anthracene	3.48E-04	=	4.51E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	1.30E+07	)]
Benzo(a)pyrene	1.10E-04	=	5.07E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	4.67E+07	)]
Benzo(b)fluoranthene	1.89E-04	=	8.48E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	4.52E+07	)]
Chrysene	4.15E-04	=	7.17E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	1.73E+07	)]
Dibenz(a,h)anthracene	1.59E-05	=	1.47E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	9.38E+07	)]
Indeno(1,2,3-cd)pyrene	4.74E-05	=	4.20E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	8.99E+07	)]
Naphthalene	2.90E-02	=	4.43E+00	x	1000	x	[(1 /	5.70E+09	) + (1 /	1.53E+05	)]
Aluminum	4.46E-03	=	2.54E+04	x	1000	x	[(1 /	5.70E+09	) + (1 /	nd	)]
Arsenic	3.49E-06	=	1.99E+01	x	1000	x	[(1 /	5.70E+09	) + (1 /	na	)]
Chromium	8.83E-06	=	5.03E+01	x	1000	x	[(1 /	5.70E+09	) + (1 /	na	)]
Cobalt	2.26E-06	=	1.29E+01	x	1000	x	[(1 /	5.70E+09	) + (1 /	na	)]
Manganese	2.50E-04	=	1.43E+03	x	1000	x	[(1 /	5.70E+09	) + (1 /	na	)]
Vanadium	7.89E-06	=	4.50E+01	x	1000	x	[(1 /	5.70E+09	) + (1 /	na	)]

CA = chemical concentration in air
CS = chemical concentration in soil
CF = conversion factor (1000 µg/mg)
PEF = particulate emission factor
na = not applicable

Table B1.20
SMA 4, Subsurface Soil, 2 - 15 ft, Chemical Concentrations in Air Calculations
ERP Coke Facility, Birmingham, AL

Equation	CA	=	CS	x	CF	x	[	(	1	/	PEF	)	+	(	1	/	VF	)	]
Units	µg/m^3		mg/kg		µg/mg						m^3/kg						m^3/kg		
Industrial/Commercial Worker																			
1,1,2-Trichloroethane	7.26E-02	=	8.10E-01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	1.12E+04	)	]
Benzene	1.59E+01	=	8.73E+01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	5.47E+03	)	]
Chlorobenzene	2.71E+01	=	2.70E+02	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	9.98E+03	)	]
Ethylbenzene	2.98E+00	=	2.61E+01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	8.77E+03	)	]
Toluene	4.13E+02	=	2.74E+03	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	6.64E+03	)	]
Vinyl chloride	7.84E-02	=	1.16E-01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	1.48E+03	)	]
Xylenes	2.23E+01	=	1.99E+02	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	8.88E+03	)	]
Benzo(a)anthracene	8.90E-04	=	5.42E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	6.10E+06	)	]
Benzo(a)pyrene	2.08E-04	=	4.54E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	2.19E+07	)	]
Benzo(b)fluoranthene	2.98E-04	=	6.28E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	2.12E+07	)	]
Benzo(k)fluoranthene	6.90E-05	=	1.46E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	2.13E+07	)	]
Carbazole	3.42E-07	=	1.95E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	na	)	]
Chrysene	6.06E-04	=	4.90E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	8.11E+06	)	]
Dibenzo(a,h)anthracene	1.10E-05	=	4.79E-01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	4.39E+07	)	]
Indeno(1,2,3-cd)pyrene	3.30E-05	=	1.38E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	4.21E+07	)	]
Naphthalene	1.12E+00	=	8.05E+01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	7.16E+04	)	]
Arsenic	1.73E-06	=	9.87E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	na	)	]
Chromium	5.74E-06	=	3.27E+01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	na	)	]
Construction Worker																			
1,1,2-Trichloroethane	7.26E-02	=	8.10E-01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	1.12E+04	)	]
Benzene	1.59E+01	=	8.73E+01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	5.47E+03	)	]
Chlorobenzene	2.71E+01	=	2.70E+02	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	9.98E+03	)	]
Ethylbenzene	2.98E+00	=	2.61E+01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	8.77E+03	)	]
Toluene	4.13E+02	=	2.74E+03	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	6.64E+03	)	]
Vinyl chloride	7.84E-02	=	1.16E-01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	1.48E+03	)	]
Xylenes	2.23E+01	=	1.99E+02	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	8.88E+03	)	]
Benzo(a)anthracene	8.90E-04	=	5.42E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	6.10E+06	)	]
Benzo(a)pyrene	2.08E-04	=	4.54E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	2.19E+07	)	]
Benzo(b)fluoranthene	2.98E-04	=	6.28E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	2.12E+07	)	]
Benzo(k)fluoranthene	6.90E-05	=	1.46E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	2.13E+07	)	]
Carbazole	3.42E-07	=	1.95E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	na	)	]
Chrysene	6.06E-04	=	4.90E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	8.11E+06	)	]
Dibenzo(a,h)anthracene	1.10E-05	=	4.79E-01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	4.39E+07	)	]
Indeno(1,2,3-cd)pyrene	3.30E-05	=	1.38E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	4.21E+07	)	]
Naphthalene	1.12E+00	=	8.05E+01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	7.16E+04	)	]
Arsenic	1.73E-06	=	9.87E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	na	)	]
Chromium	5.74E-06	=	3.27E+01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	na	)	]

CA = chemical concentration in air
CS = chemical concentration in soil
CF = conversion factor (1000 µg/mg)
PEF = particulate emission factor

Table B1.21
SMA 4, Mineral Wool Pile - Chemical Concentrations in Air Calculations
ERP Coke Facility, Birmingham, AL

Equation	CA	=	CS	x	CF	x	[	(	1	/	PEF	)	+	(	1	/	VF	)	]
Units	µg/m^3		mg/kg		µg/mg						m^3/kg						m^3/kg		
Benzo(a)pyrene	2.26E-06	=	1.04E-01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	4.65E+07	)	]
Benzo(a)anthracene	7.81E-06	=	1.01E-01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	1.30E+07	)	]
Benzo(b)fluoranthene	1.82E-06	=	8.12E-02	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	4.50E+07	)	]
Chrysene	5.11E-06	=	8.78E-02	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	1.72E+07	)	]
Dibenz(a,h)anthracene	7.08E-07	=	6.50E-02	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	9.34E+07	)	]
Indeno(1,2,3-cd)pyrene	3.92E-07	=	3.45E-02	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	8.95E+07	)	]
Carbazole	3.33E-09	=	1.90E-02	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	na	)	]
Arsenic	4.24E-07	=	2.42E+00	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	na	)	]
Chromium	6.06E-06	=	3.46E+01	x	1000	x	[	(	1	/	5.70E+09	)	+	(	1	/	na	)	]

CA = chemical concentration in air na = not applicable
CS = chemical concentration in mineral wool
CF = conversion factor (1000 µg/mg)
PEF = particulate emission factor

Table B1.22
SMA 4, Surface Soil 0 - 1 ft, Daily Intake Calculations: Industrial/Commercial Worker
Inhalation of Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	EC	= [	CA	x	ET	x	EF	x	ED	x	CF	] / [	AT	]
Units	**µg/m³**		**µg/m³**		**hours/day**		**days/year**		**years**		**days/hour**		**days**	
CARCINOGENIC EFFECTS														
Carbazole	1.57E-09	= [	1.91E-08	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Benz(a)anthracene	2.86E-05	= [	3.48E-04	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Benzo(a)pyrene	9.00E-06	= [	1.10E-04	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Benzo(b)fluoranthene	1.55E-05	= [	1.89E-04	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Chrysene	3.41E-05	= [	4.15E-04	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Dibenz(a,h)anthracene	1.31E-06	= [	1.59E-05	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Indeno(1,2,3-cd)pyrene	3.90E-06	= [	4.74E-05	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Arsenic	2.87E-07	= [	3.49E-06	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Chromium	7.26E-07	= [	8.83E-06	x	8	x	250	x	25	x	0.042	] / [	25,550	]
NONCARCINOGENIC EFFECTS														
Carbazole	4.40E-09	= [	1.91E-08	x	8	x	250	x	25		0.042	] / [	9,125	]
Benz(a)anthracene	8.00E-05	= [	3.48E-04	x	8	x	250	x	25		0.042	] / [	9,125	]
Benzo(a)pyrene	2.52E-05	= [	1.10E-04	x	8	x	250	x	25		0.042	] / [	9,125	]
Benzo(b)fluoranthene	4.35E-05	= [	1.89E-04	x	8	x	250	x	25		0.042	] / [	9,125	]
Chrysene	9.56E-05	= [	4.15E-04	x	8	x	250	x	25		0.042	] / [	9,125	]
Dibenz(a,h)anthracene	3.66E-06	= [	1.59E-05	x	8	x	250	x	25		0.042	] / [	9,125	]
Indeno(1,2,3-cd)pyrene	1.09E-05	= [	4.74E-05	x	8	x	250	x	25		0.042	] / [	9,125	]
Arsenic	8.03E-07	= [	3.49E-06	x	8	x	250	x	25		0.042	] / [	9,125	]
Chromium	2.03E-06	= [	8.83E-06	x	8	x	250	x	25		0.042	] / [	9,125	]

EC = exposure concentration
CA = chemical concentration in air
ET = exposure time
EF = exposure frequency
ED = exposure duration
CF = conversion factor (1 day/24 hours)
AT = averaging time

Table B1.23
SMA 4, Surface Soil 0 - 1 ft, Daily Intake Calculations: Construction Worker
Inhalation of Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	EC	= [	CA	x	ET	x	EF	x	ED	x	CF	] / [	AT	]
Units	**µg/m^3**		**µg/m^3**		**hours/day**		**days/year**		**years**		**day/hour**		**days**	
CARCINOGENIC EFFECTS														
Carbazole	9.05E-12	= [	1.91E-08	x	8	x	36	x	1	x	0.042	] / [	25,550	]
Benz(a)anthracene	1.65E-07	= [	3.48E-04	x	8	x	36	x	1	x	0.042	] / [	25,550	]
Benzo(a)pyrene	5.19E-08	= [	1.10E-04	x	8	x	36	x	1	x	0.042	] / [	25,550	]
Benzo(b)fluoranthene	8.95E-08	= [	1.89E-04	x	8	x	36	x	1	x	0.042	] / [	25,550	]
Chrysene	1.97E-07	= [	4.15E-04	x	8	x	36	x	1	x	0.042	] / [	25,550	]
Dibenz(a,h)anthracene	7.54E-09	= [	1.59E-05	x	8	x	36	x	1	x	0.042	] / [	25,550	]
Indeno(1,2,3-cd)pyrene	2.24E-08	= [	4.74E-05	x	8	x	36	x	1	x	0.042	] / [	25,550	]
Arsenic	1.65E-09	= [	3.49E-06	x	8	x	36	x	1	x	0.042	] / [	25,550	]
Chromium	4.18E-09	= [	8.83E-06	x	8	x	36	x	1	x	0.042	] / [	25,550	]
NONCARCINOGENIC EFFECTS														
Carbazole	6.34E-10	= [	1.91E-08	x	8	x	36	x	1	x	0.042	] / [	365	]
Benz(a)anthracene	1.15E-05	= [	3.48E-04	x	8	x	36	x	1	x	0.042	] / [	365	]
Benzo(a)pyrene	3.63E-06	= [	1.10E-04	x	8	x	36	x	1	x	0.042	] / [	365	]
Benzo(b)fluoranthene	6.27E-06	= [	1.89E-04	x	8	x	36	x	1	x	0.042	] / [	365	]
Chrysene	1.38E-05	= [	4.15E-04	x	8	x	36	x	1	x	0.042	] / [	365	]
Dibenz(a,h)anthracene	5.28E-07	= [	1.59E-05	x	8	x	36	x	1	x	0.042	] / [	365	]
Indeno(1,2,3-cd)pyrene	1.57E-06	= [	4.74E-05	x	8	x	36	x	1	x	0.042	] / [	365	]
Arsenic	1.16E-07	= [	3.49E-06	x	8	x	36	x	1	x	0.042	] / [	365	]
Chromium	2.93E-07	= [	8.83E-06	x	8	x	36	x	1	x	0.042	] / [	365	]

EC = exposure concentration
CA = chemical concentration in air
ET = exposure time
EF = exposure frequency
ED = exposure duration
CF = conversion factor (1 day/24 hours)
AT = averaging time

Table B1.24
SMA 4, Surface Soil, 0 - 1 ft - Daily Intake Calculations: Adolescent Trespasser
Inhalation of Chemicals in Soil 0 - 1 ft depth
ERP Coke Facility, Birmingham, AL

Equation	EC	= [	CA	x	ET	x	EF	x	ED	x	CF	] / [	AT	]
Units	**µg/m³**		**µg/m³**		**hours/day**		**days/year**		**years**		**day/hour**		**days**	
CARCINOGENIC EFFECTS														
Carbazole	3.77E-12	= [	1.91E-08	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Benz(a)anthracene	6.86E-08	= [	3.48E-04	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Benzo(a)pyrene	2.16E-08	= [	1.10E-04	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Benzo(b)fluoranthene	3.73E-08	= [	1.89E-04	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Chrysene	8.19E-08	= [	4.15E-04	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Dibenz(a,h)anthracene	3.14E-09	= [	1.59E-05	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Indeno(1,2,3-cd)pyrene	9.35E-09	= [	4.74E-05	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Naphthalene	5.72E-06	= [	2.90E-02	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Aluminum	8.80E-07	= [	4.46E-03	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Arsenic	6.88E-10	= [	3.49E-06	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Chromium	1.74E-09	= [	8.83E-06	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Cobalt	4.46E-10	= [	2.26E-06	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Manganese	4.94E-08	= [	2.50E-04	x	1	x	12	x	10	x	0.042	] / [	25,550	]
Vanadium	1.56E-09	= [	7.89E-06	x	1	x	12	x	10	x	0.042	] / [	25,550	]
NONCARCINOGENIC EFFECTS														
Carbazole	2.64E-11	= [	1.91E-08	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Benz(a)anthracene	4.80E-07	= [	3.48E-04	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Benzo(a)pyrene	1.51E-07	= [	1.10E-04	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Benzo(b)fluoranthene	2.61E-07	= [	1.89E-04	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Chrysene	5.73E-07	= [	4.15E-04	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Dibenz(a,h)anthracene	2.20E-08	= [	1.59E-05	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Indeno(1,2,3-cd)pyrene	6.55E-08	= [	4.74E-05	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Naphthalene	4.00E-05	= [	2.90E-02	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Aluminum	6.16E-06	= [	4.46E-03	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Arsenic	4.82E-09	= [	3.49E-06	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Chromium	1.22E-08	= [	8.83E-06	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Cobalt	3.13E-09	= [	2.26E-06	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Manganese	3.46E-07	= [	2.50E-04	x	1	x	12	x	10	x	0.042	] / [	3,650	]
Vanadium	1.09E-08	= [	7.89E-06	x	1	x	12	x	10	x	0.042	] / [	3,650	]

EC = exposure concentration
CA = chemical concentration in air
ET = exposure time
EF = exposure frequency
ED = exposure duration
CF = conversion factor (1 day/24 hours)
AT = averaging time

Table B1.25
SMA 4, Subsurface Soil, 2 - 15 ft, Daily Intake Calculations: Industrial/Commercial Worker
Inhalation of Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	EC	= [	CA	x	ET	x	EF	x	ED	x	CF	] / [	AT	]
Units	**µg/m³**		**µg/m³**		**hours/day**		**days/year**		**years**		**days/hour**		**days**	
CARCINOGENIC EFFECTS														
1,1,2-Trichloroethane	1.19E-04	= [	7.26E-02	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Benzene	2.62E-02	= [	1.59E+01	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Chlorobenzene	4.45E-02	= [	2.71E+01	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Ethylbenzene	4.89E-03	= [	2.98E+00	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Toluene	6.80E-01	= [	4.13E+02	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Vinyl chloride	1.29E-04	= [	7.84E-02	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Xylenes	3.67E-02	= [	2.23E+01	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Benzo(a)anthracene	1.46E-06	= [	8.90E-04	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Benzo(a)pyrene	3.42E-07	= [	2.08E-04	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Benzo(b)fluoranthene	4.89E-07	= [	2.98E-04	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Benzo(k)fluoranthene	1.13E-07	= [	6.90E-05	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Carbazole	5.63E-10	= [	3.42E-07	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Chrysene	9.96E-07	= [	6.06E-04	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Dibenzo(a,h)anthracene	1.81E-08	= [	1.10E-05	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Indeno(1,2,3-cd)pyrene	5.43E-08	= [	3.30E-05	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Naphthalene	1.85E-03	= [	1.12E+00	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Arsenic	2.85E-09	= [	1.73E-06	x	8	x	5	x	25	x	0.042	] / [	25,550	]
Chromium	9.43E-09	= [	5.74E-06	x	8	x	5	x	25	x	0.042	] / [	25,550	]
NONCARCINOGENIC EFFECTS														
1,1,2-Trichloroethane	3.34E-04	= [	7.26E-02	x	8	x	5	x	25		0.042	] / [	9,125	]
Benzene	7.34E-02	= [	1.59E+01	x	8	x	5	x	25		0.042	] / [	9,125	]
Chlorobenzene	1.25E-01	= [	2.71E+01	x	8	x	5	x	25		0.042	] / [	9,125	]
Ethylbenzene	1.37E-02	= [	2.98E+00	x	8	x	5	x	25		0.042	] / [	9,125	]
Toluene	1.90E+00	= [	4.13E+02	x	8	x	5	x	25		0.042	] / [	9,125	]
Vinyl chloride	3.61E-04	= [	7.84E-02	x	8	x	5	x	25		0.042	] / [	9,125	]
Xylenes	1.03E-01	= [	2.23E+01	x	8	x	5	x	25		0.042	] / [	9,125	]
Benzo(a)anthracene	4.10E-06	= [	8.90E-04	x	8	x	5	x	25		0.042	] / [	9,125	]
Benzo(a)pyrene	9.59E-07	= [	2.08E-04	x	8	x	5	x	25		0.042	] / [	9,125	]
Benzo(b)fluoranthene	1.37E-06	= [	2.98E-04	x	8	x	5	x	25		0.042	] / [	9,125	]
Benzo(k)fluoranthene	3.17E-07	= [	6.90E-05	x	8	x	5	x	25		0.042	] / [	9,125	]
Carbazole	1.58E-09	= [	3.42E-07	x	8	x	5	x	25		0.042	] / [	9,125	]
Chrysene	2.79E-06	= [	6.06E-04	x	8	x	5	x	25		0.042	] / [	9,125	]
Dibenzo(a,h)anthracene	5.06E-08	= [	1.10E-05	x	8	x	5	x	25		0.042	] / [	9,125	]
Indeno(1,2,3-cd)pyrene	1.52E-07	= [	3.30E-05	x	8	x	5	x	25		0.042	] / [	9,125	]
Naphthalene	5.17E-03	= [	1.12E+00	x	8	x	5	x	25		0.042	] / [	9,125	]
Arsenic	7.97E-09	= [	1.73E-06	x	8	x	5	x	25		0.042	] / [	9,125	]
Chromium	2.64E-08	= [	5.74E-06	x	8	x	5	x	25		0.042	] / [	9,125	]

EC = exposure concentration
CA = chemical concentration in air
ET = exposure time
EF = exposure frequency
ED = exposure duration
CF = conversion factor (1 day/24 hours)
AT = averaging time

Table B1.26
SMA 4, Subsurface Soil, 2 - 15 ft, Daily Intake Calculations: Construction Worker
Inhalation of Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	EC	= [	CA	x	ET	x	EF	x	ED	x	CF	] / [	AT	]
Units	**µg/m³**		**µg/m³**		**hours/day**		**days/year**		**years**		**day/hour**		**days**	
CARCINOGENIC EFFECTS														
1,1,2-Trichloroethane	2.39E-04	= [	7.26E-02	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Benzene	5.24E-02	= [	1.59E+01	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Chlorobenzene	8.91E-02	= [	2.71E+01	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Ethylbenzene	9.78E-03	= [	2.98E+00	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Toluene	1.36E+00	= [	4.13E+02	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Vinyl chloride	2.58E-04	= [	7.84E-02	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Xylenes	7.35E-02	= [	2.23E+01	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Benzo(a)anthracene	2.93E-06	= [	8.90E-04	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Benzo(a)pyrene	6.85E-07	= [	2.08E-04	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Benzo(b)fluoranthene	9.78E-07	= [	2.98E-04	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Benzo(k)fluoranthene	2.27E-07	= [	6.90E-05	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Carbazole	1.13E-09	= [	3.42E-07	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Chrysene	1.99E-06	= [	6.06E-04	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Dibenzo(a,h)anthracene	3.61E-08	= [	1.10E-05	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Indeno(1,2,3-cd)pyrene	1.09E-07	= [	3.30E-05	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Naphthalene	3.70E-03	= [	1.12E+00	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Arsenic	5.69E-09	= [	1.73E-06	x	8	x	250	x	1	x	0.042	] / [	25,550	]
Chromium	1.89E-08	= [	5.74E-06	x	8	x	250	x	1	x	0.042	] / [	25,550	]
NONCARCINOGENIC EFFECTS														
1,1,2-Trichloroethane	1.67E-02	= [	7.26E-02	x	8	x	250	x	1	x	0.042	] / [	365	]
Benzene	3.67E+00	= [	1.59E+01	x	8	x	250	x	1	x	0.042	] / [	365	]
Chlorobenzene	6.24E+00	= [	2.71E+01	x	8	x	250	x	1	x	0.042	] / [	365	]
Ethylbenzene	6.85E-01	= [	2.98E+00	x	8	x	250	x	1	x	0.042	] / [	365	]
Toluene	9.52E+01	= [	4.13E+02	x	8	x	250	x	1	x	0.042	] / [	365	]
Vinyl chloride	1.80E-02	= [	7.84E-02	x	8	x	250	x	1	x	0.042	] / [	365	]
Xylenes	5.14E+00	= [	2.23E+01	x	8	x	250	x	1	x	0.042	] / [	365	]
Benzo(a)anthracene	2.05E-04	= [	8.90E-04	x	8	x	250	x	1	x	0.042	] / [	365	]
Benzo(a)pyrene	4.79E-05	= [	2.08E-04	x	8	x	250	x	1	x	0.042	] / [	365	]
Benzo(b)fluoranthene	6.85E-05	= [	2.98E-04	x	8	x	250	x	1	x	0.042	] / [	365	]
Benzo(k)fluoranthene	1.59E-05	= [	6.90E-05	x	8	x	250	x	1	x	0.042	] / [	365	]
Carbazole	7.88E-08	= [	3.42E-07	x	8	x	250	x	1	x	0.042	] / [	365	]
Chrysene	1.39E-04	= [	6.06E-04	x	8	x	250	x	1	x	0.042	] / [	365	]
Dibenzo(a,h)anthracene	2.53E-06	= [	1.10E-05	x	8	x	250	x	1	x	0.042	] / [	365	]
Indeno(1,2,3-cd)pyrene	7.60E-06	= [	3.30E-05	x	8	x	250	x	1	x	0.042	] / [	365	]
Naphthalene	2.59E-01	= [	1.12E+00	x	8	x	250	x	1	x	0.042	] / [	365	]
Arsenic	3.98E-07	= [	1.73E-06	x	8	x	250	x	1	x	0.042	] / [	365	]
Chromium	1.32E-06	= [	5.74E-06	x	8	x	250	x	1	x	0.042	] / [	365	]

EC = exposure concentration
CA = chemical concentration in air
ET = exposure time
EF = exposure frequency
ED = exposure duration
CF = conversion factor (1 day/24 hours)
AT = averaging time

Table B1.27
SMA 4, Mineral Wool Pile - Daily Intake Calculations: Industrial/Commercial Worker
Inhalation of Chemicals in the Mineral Wool Pile
ERP Coke Facility, Birmingham, AL

Equation	EC	= [	CA	x	ET	x	EF	x	ED	x	CF	] / [	AT	]
Units	**µg/m³**		**µg/m³**		**hours/day**		**days/year**		**years**		**days/hour**		**days**	
CARCINOGENIC EFFECTS														
Benzo(a)pyrene	1.86E-07	= [	2.26E-06	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Benzo(a)anthracene	6.42E-07	= [	7.81E-06	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Benzo(b)fluoranthene	1.50E-07	= [	1.82E-06	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Chrysene	4.20E-07	= [	5.11E-06	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Dibenz(a,h)anthracene	5.82E-08	= [	7.08E-07	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Indeno(1,2,3-cd)pyrene	3.22E-08	= [	3.92E-07	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Carbazole	2.74E-10	= [	3.33E-09	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Arsenic	3.49E-08	= [	4.24E-07	x	8	x	250	x	25	x	0.042	] / [	25,550	]
Chromium	4.98E-07	= [	6.06E-06	x	8	x	250	x	25	x	0.042	] / [	25,550	]
NONCARCINOGENIC EFFECTS														
Benzo(a)pyrene	5.19E-07	= [	2.26E-06	x	8	x	250	x	25		0.042	] / [	9,125	]
Benzo(a)anthracene	1.80E-06	= [	7.81E-06	x	8	x	250	x	25		0.042	] / [	9,125	]
Benzo(b)fluoranthene	4.19E-07	= [	1.82E-06	x	8	x	250	x	25		0.042	] / [	9,125	]
Chrysene	1.18E-06	= [	5.11E-06	x	8	x	250	x	25		0.042	] / [	9,125	]
Dibenz(a,h)anthracene	1.63E-07	= [	7.08E-07	x	8	x	250	x	25		0.042	] / [	9,125	]
Indeno(1,2,3-cd)pyrene	9.01E-08	= [	3.92E-07	x	8	x	250	x	25		0.042	] / [	9,125	]
Carbazole	7.67E-10	= [	3.33E-09	x	8	x	250	x	25		0.042	] / [	9,125	]
Arsenic	9.76E-08	= [	4.24E-07	x	8	x	250	x	25		0.042	] / [	9,125	]
Chromium	1.39E-06	= [	6.06E-06	x	8	x	250	x	25		0.042	] / [	9,125	]

EC = exposure concentration
CA = chemical concentration in air
ET = exposure time
EF = exposure frequency
ED = exposure duration
CF = conversion factor (1 day/24 hours)
AT = averaging time

Table B1.28
SMA 4, Mineral Wool Pile - Daily Intake Calculations: Adult Resident
Inhalation of Chemicals in the Mineral Wool Pile
ERP Coke Facility, Birmingham, AL

Equation	EC	= [	CA	x	ET	x	EF	x	ED	x	CF	] / [	AT	]
Units	**µg/m³**		**µg/m³**		**hours/day**		**days/year**		**years**		**day/hour**		**days**	
CARCINOGENIC EFFECTS														
Benzo(a)pyrene	8.10E-07	= [	2.26E-06	x	24	x	350	x	26	x	0.042	] / [	25,550	]
Benzo(a)anthracene	2.81E-06	= [	7.81E-06	x	24	x	350	x	26	x	0.042	] / [	25,550	]
Benzo(b)fluoranthene	6.53E-07	= [	1.82E-06	x	24	x	350	x	26	x	0.042	] / [	25,550	]
Chrysene	1.84E-06	= [	5.11E-06	x	24	x	350	x	26	x	0.042	] / [	25,550	]
Dibenz(a,h)anthracene	2.54E-07	= [	7.08E-07	x	24	x	350	x	26	x	0.042	] / [	25,550	]
Indeno(1,2,3-cd)pyrene	1.41E-07	= [	3.92E-07	x	24	x	350	x	26	x	0.042	] / [	25,550	]
Carbazole	1.20E-09	= [	3.33E-09	x	24	x	350	x	26	x	0.042	] / [	25,550	]
Arsenic	1.52E-07	= [	4.24E-07	x	24	x	350	x	26	x	0.042	] / [	25,550	]
Chromium	2.18E-06	= [	6.06E-06	x	24	x	350	x	26	x	0.042	] / [	25,550	]
NONCARCINOGENIC EFFECTS														
Benzo(a)pyrene	2.18E-06	= [	2.26E-06	x	24	x	350	x	26	x	0.042	] / [	9,490	]
Benzo(a)anthracene	7.55E-06	= [	7.81E-06	x	24	x	350	x	26	x	0.042	] / [	9,490	]
Benzo(b)fluoranthene	1.76E-06	= [	1.82E-06	x	24	x	350	x	26	x	0.042	] / [	9,490	]
Chrysene	4.94E-06	= [	5.11E-06	x	24	x	350	x	26	x	0.042	] / [	9,490	]
Dibenz(a,h)anthracene	6.84E-07	= [	7.08E-07	x	24	x	350	x	26	x	0.042	] / [	9,490	]
Indeno(1,2,3-cd)pyrene	3.79E-07	= [	3.92E-07	x	24	x	350	x	26	x	0.042	] / [	9,490	]
Carbazole	3.22E-09	= [	3.33E-09	x	24	x	350	x	26	x	0.042	] / [	9,490	]
Arsenic	4.10E-07	= [	4.24E-07	x	24	x	350	x	26	x	0.042	] / [	9,490	]
Chromium	5.86E-06	= [	6.06E-06	x	24	x	350	x	26	x	0.042	] / [	9,490	]

EC = exposure concentration
CA = chemical concentration in air
ET = exposure time
EF = exposure frequency
ED = exposure duration
CF = conversion factor (1 day/24 hours)
AT = averaging time

Table B1.29
SMA 4, Mineral Wool Pile - Daily Intake Calculations: Child Resident
Inhalation of Chemicals in the Mineral Wool Pile
ERP Coke Facility, Birmingham, AL

Equation	EC	= [	CA	x	ET	x	EF	x	ED	x	CF	] / [	AT	]
Units	**µg/m³**		**µg/m³**		**hours/day**		**days/year**		**years**		**day/hour**		**days**	
CARCINOGENIC EFFECTS														
Benzo(a)pyrene	6.23E-08	= [	2.26E-06	x	24	x	350	x	2	x	0.042	] / [	25,550	]
Benzo(a)pyrene	1.25E-07	= [	2.26E-06	x	24	x	350	x	4	x	0.042	] / [	25,550	]
Benzo(a)anthracene	2.16E-07	= [	7.81E-06	x	24	x	350	x	2	x	0.042	] / [	25,550	]
Benzo(a)anthracene	4.32E-07	= [	7.81E-06	x	24	x	350	x	4	x	0.042	] / [	25,550	]
Benzo(b)fluoranthene	5.02E-08	= [	1.82E-06	x	24	x	350	x	2	x	0.042	] / [	25,550	]
Benzo(b)fluoranthene	1.00E-07	= [	1.82E-06	x	24	x	350	x	4	x	0.042	] / [	25,550	]
Chrysene	1.41E-07	= [	5.11E-06	x	24	x	350	x	2	x	0.042	] / [	25,550	]
Chrysene	2.82E-07	= [	5.11E-06	x	24	x	350	x	4	x	0.042	] / [	25,550	]
Dibenz(a,h)anthracene	1.95E-08	= [	7.08E-07	x	24	x	350	x	2	x	0.042	] / [	25,550	]
Dibenz(a,h)anthracene	3.91E-08	= [	7.08E-07	x	24	x	350	x	4	x	0.042	] / [	25,550	]
Indeno(1,2,3-cd)pyrene	1.08E-08	= [	3.92E-07	x	24	x	350	x	2	x	0.042	] / [	25,550	]
Indeno(1,2,3-cd)pyrene	2.16E-08	= [	3.92E-07	x	24	x	350	x	4	x	0.042	] / [	25,550	]
Carbazole	9.21E-11	= [	3.33E-09	x	24	x	350	x	2	x	0.042	] / [	25,550	]
Carbazole	1.84E-10	= [	3.33E-09	x	24	x	350	x	4	x	0.042	] / [	25,550	]
Arsenic	1.17E-08	= [	4.24E-07	x	24	x	350	x	2	x	0.042	] / [	25,550	]
Arsenic	2.34E-08	= [	4.24E-07	x	24	x	350	x	4	x	0.042	] / [	25,550	]
Chromium	1.67E-07	= [	6.06E-06	x	24	x	350	x	2	x	0.042	] / [	25,550	]
Chromium	3.35E-07	= [	6.06E-06	x	24	x	350	x	4	x	0.042	] / [	25,550	]
NONCARCINOGENIC EFFECTS														
Benzo(a)pyrene	2.18E-06	= [	2.26E-06	x	24	x	350	x	2	x	0.042	] / [	730	]
Benzo(a)pyrene	2.18E-06	= [	2.26E-06	x	24	x	350	x	4	x	0.042	] / [	1,460	]
Benzo(a)anthracene	7.55E-06	= [	7.81E-06	x	24	x	350	x	2	x	0.042	] / [	730	]
Benzo(a)anthracene	7.55E-06	= [	7.81E-06	x	24	x	350	x	4	x	0.042	] / [	1,460	]
Benzo(b)fluoranthene	1.76E-06	= [	1.82E-06	x	24	x	350	x	2	x	0.042	] / [	730	]
Benzo(b)fluoranthene	1.76E-06	= [	1.82E-06	x	24	x	350	x	4	x	0.042	] / [	1,460	]
Chrysene	4.94E-06	= [	5.11E-06	x	24	x	350	x	2	x	0.042	] / [	730	]
Chrysene	4.94E-06	= [	5.11E-06	x	24	x	350	x	4	x	0.042	] / [	1,460	]
Dibenz(a,h)anthracene	6.84E-07	= [	7.08E-07	x	24	x	350	x	2	x	0.042	] / [	730	]
Dibenz(a,h)anthracene	6.84E-07	= [	7.08E-07	x	24	x	350	x	4	x	0.042	] / [	1,460	]
Indeno(1,2,3-cd)pyrene	3.79E-07	= [	3.92E-07	x	24	x	350	x	2	x	0.042	] / [	730	]
Indeno(1,2,3-cd)pyrene	3.79E-07	= [	3.92E-07	x	24	x	350	x	4	x	0.042	] / [	1,460	]
Carbazole	3.22E-09	= [	3.33E-09	x	24	x	350	x	2	x	0.042	] / [	730	]
Carbazole	3.22E-09	= [	3.33E-09	x	24	x	350	x	4	x	0.042	] / [	1,460	]
Arsenic	4.10E-07	= [	4.24E-07	x	24	x	350	x	2	x	0.042	] / [	730	]
Arsenic	4.10E-07	= [	4.24E-07	x	24	x	350	x	4	x	0.042	] / [	1,460	]
Chromium	5.86E-06	= [	6.06E-06	x	24	x	350	x	2	x	0.042	] / [	730	]
Chromium	5.86E-06	= [	6.06E-06	x	24	x	350	x	4	x	0.042	] / [	1,460	]

EC = exposure concentration
CA = chemical concentration in air
ET = exposure time
EF = exposure frequency
ED = exposure duration
CF = conversion factor (1 day/24 hours)
AT = averaging time

Table B1.30
SMA 4, Surface Soil, 0 - 1 ft - Daily Intake Calculations
Dermal Contact with Chemicals in Soil - Absorbed dose per event (DA_{event})
ERP Coke Facility, Birmingham, AL

Equation	DA_{event}	= [	CS	x	CF	x	AF	x	ABS_d
Units	**mg/kg-event**		**mg/kg**		**kg/mg**		**mg/cm^2-event**		**unitless**
Workers									
Carbazole	1.31E-09	= [	1.09E-01	x	1.00E-06	x	0.12	x	0.1
Benz(a)anthracene	7.04E-08	= [	4.51E+00	x	1.00E-06	x	0.12	x	0.13
Benzo(a)pyrene	7.91E-08	= [	5.07E+00	x	1.00E-06	x	0.12	x	0.13
Benzo(b)fluoranthene	1.32E-07	= [	8.48E+00	x	1.00E-06	x	0.12	x	0.13
Chrysene	1.12E-07	= [	7.17E+00	x	1.00E-06	x	0.12	x	0.13
Dibenz(a,h)anthracene	2.29E-08	= [	1.47E+00	x	1.00E-06	x	0.12	x	0.13
Indeno(1,2,3-cd)pyrene	6.54E-08	= [	4.20E+00	x	1.00E-06	x	0.12	x	0.13
Arsenic	7.16E-08	= [	1.99E+01	x	1.00E-06	x	0.12	x	0.03
Chromium	na	= [	5.03E+01	x	1.00E-06	x	0.12	x	nd
Trespassers									
Carbazole	2.18E-09	= [	1.09E-01	x	1.00E-06	x	0.2	x	0.1
Benz(a)anthracene	1.17E-07	= [	4.51E+00	x	1.00E-06	x	0.2	x	0.13
Benzo(a)pyrene	1.32E-07	= [	5.07E+00	x	1.00E-06	x	0.2	x	0.13
Benzo(b)fluoranthene	2.20E-07	= [	8.48E+00	x	1.00E-06	x	0.2	x	0.13
Chrysene	1.86E-07	= [	7.17E+00	x	1.00E-06	x	0.2	x	0.13
Dibenz(a,h)anthracene	3.82E-08	= [	1.47E+00	x	1.00E-06	x	0.2	x	0.13
Indeno(1,2,3-cd)pyrene	1.09E-07	= [	4.20E+00	x	1.00E-06	x	0.2	x	0.13
Naphthalene	1.15E-07	= [	4.43E+00	x	1.00E-06	x	0.2	x	0.13
Aluminum	na	= [	2.54E+04	x	1.00E-06	x	0.2	x	nd
Arsenic	1.19E-07	= [	1.99E+01	x	1.00E-06	x	0.2	x	0.03
Chromium	na	= [	5.03E+01	x	1.00E-06	x	0.2	x	nd
Cobalt	na	= [	1.29E+01	x	1.00E-06	x	0.2	x	nd
Manganese	na	= [	1.43E+03	x	1.00E-06	x	0.2	x	nd
Vanadium	na	= [	4.50E+01	x	1.00E-06	x	0.2	x	nd

DA_{event} = absorbed dose per event (mg/cm^2-event)
CS = chemical concentration in soil
CF = conversion factor
AF =soil to skin adherence factor
ABS_d = dermal absorption fraction, per exhibit 3-4 in RAGS Part E (USEPA, 2004)

na = not applicable
nd = no data

ABS_d parameters are unavailable for VOCs and most metals

values
SVOCs = 0.1
PAHs = 0.13
As = 0.03

Table B1.31
SMA 4, Subsurface Soil, 2 - 15 ft, Daily Intake Calculations
Dermal Contact with Chemicals in Soil - Absorbed dose per event (Da_{event})
ERP Coke Facility, Birmingham, AL

Equation	DA_{event}	= [	CS	x	CF	x	AF	x	ABS_d
Units	**mg/kg-event**		**mg/kg**		**kg/mg**		**mg/cm^2-event**		**unitless**
1,1,2-Trichloroethane	na	= [	8.10E-01	x	1.00E-06	x	0.12	x	nd
Benzene	na	= [	8.73E+01	x	1.00E-06	x	0.12	x	nd
Chlorobenzene	na	= [	2.70E+02	x	1.00E-06	x	0.12	x	nd
Ethylbenzene	na	= [	2.61E+01	x	1.00E-06	x	0.12	x	nd
Toluene	na	= [	2.74E+03	x	1.00E-06	x	0.12	x	nd
Vinyl chloride	na	= [	1.16E-01	x	1.00E-06	x	0.12	x	nd
Xylenes	na	= [	1.99E+02	x	1.00E-06	x	0.12	x	nd
Benzo(a)anthracene	8.46E-08	= [	5.42E+00	x	1.00E-06	x	0.12	x	0.13
Benzo(a)pyrene	7.08E-08	= [	4.54E+00	x	1.00E-06	x	0.12	x	0.13
Benzo(b)fluoranthene	9.79E-08	= [	6.28E+00	x	1.00E-06	x	0.12	x	0.13
Benzo(k)fluoranthene	2.28E-08	= [	1.46E+00	x	1.00E-06	x	0.12	x	0.13
Carbazole	2.34E-08	= [	1.95E+00	x	1.00E-06	x	0.12	x	0.1
Chrysene	7.65E-08	= [	4.90E+00	x	1.00E-06	x	0.12	x	0.13
Dibenzo(a,h)anthracene	7.47E-09	= [	4.79E-01	x	1.00E-06	x	0.12	x	0.13
Indeno(1,2,3-cd)pyrene	2.15E-08	= [	1.38E+00	x	1.00E-06	x	0.12	x	0.13
Naphthalene	1.26E-06	= [	8.05E+01	x	1.00E-06	x	0.12	x	0.13
Arsenic	3.55E-08	= [	9.87E+00	x	1.00E-06	x	0.12	x	0.03
Chromium	na	= [	3.27E+01	x	1.00E-06	x	0.12	x	nd

DA_{event} = absorbed dose per event (mg/cm^2-event)
CS = chemical concentration in soil
CF = conversion factor
SAF =soil to skin adherence factor
ABS_d = dermal absorption fraction, per exhibit 3-4 in RAGS Part E, Dermal Risk Assessment (USEPA, 2004)

na = not applicable
nd = no data

values

ABS_d parameters unavailable for VOCs and most metals

Arsenic = .03
SVOCs = 0.1
PAHs = 0.13

Table B1.32
SMA 4, Mineral Wool Pile - Daily Intake Calculations, Industrial/Commercial Worker
Dermal Contact with Chemicals in Mineral Wool - Absorbed dose per event (Daevent)
ERP Coke Facility, Birmingham, AL

Equation	DA_{event}	= [	CS	x	CF	x	AF	x	ABS_d
Units	**mg/kg-event**		**mg/kg**		**kg/mg**		**mg/cm^2-event**		**unitless**
Benzo(a)pyrene	1.62E-09	= [	1.04E-01	x	1.00E-06	x	0.12	x	0.13
Benzo(a)anthracene	1.58E-09	= [	1.01E-01	x	1.00E-06	x	0.12	x	0.13
Benzo(b)fluoranthene	1.27E-09	= [	8.12E-02	x	1.00E-06	x	0.12	x	0.13
Chrysene	1.37E-09	= [	8.78E-02	x	1.00E-06	x	0.12	x	0.13
Dibenz(a,h)anthracene	1.01E-09	= [	6.50E-02	x	1.00E-06	x	0.12	x	0.13
Indeno(1,2,3-cd)pyrene	5.38E-10	= [	3.45E-02	x	1.00E-06	x	0.12	x	0.13
Carbazole	2.28E-10	= [	1.90E-02	x	1.00E-06	x	0.12	x	0.1
Arsenic	8.70E-09	= [	2.42E+00	x	1.00E-06	x	0.12	x	0.03
Chromium	na	= [	3.46E+01	x	1.00E-06	x	0.12	x	nd

SWA = slag waste aggregate

DA_{event} = absorbed dose per event (mg/cm^2-event)

CS = chemical concentration, mineral wool

CF = conversion factor

AF =soil to skin adherence factor

ABS_d = dermal absorption fraction, per exhibit 3-4 in RAGS Part E (USEPA, 2004)

nd = no data

na = not applicable

<u>values</u>

PAHs = 0.13

As = 0.03

SVOCs = 0.1

ABS_d parameters unavailable for VOCs and most metals

Table B1.33
SMA 4, Surface Soil 0 - 1 ft, Daily Intake Calculations: Industrial/Commercial Worker
Dermal Contact with Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	DAD	= [	DA_{event}	x	EF	x	ED	x	EV	x	SA	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/cm^2-event**		**days/year**		**years**		**events/day**		**cm^2**		**kg**		**days**	
CARCINOGENIC EFFECTS																
Carbazole	1.39E-08	= [	1.31E-09	x	250	x	25	x	1	x	3470	] / [	80	x	25,550	]
Benz(a)anthracene	7.47E-07	= [	7.04E-08	x	250	x	25	x	1	x	3470	] / [	80	x	25,550	]
Benzo(a)pyrene	8.39E-07	= [	7.91E-08	x	250	x	25	x	1	x	3470	] / [	80	x	25,550	]
Benzo(b)fluoranthene	1.40E-06	= [	1.32E-07	x	250	x	25	x	1	x	3470	] / [	80	x	25,550	]
Chrysene	1.19E-06	= [	1.12E-07	x	250	x	25	x	1	x	3470	] / [	80	x	25,550	]
Dibenz(a,h)anthracene	2.43E-07	= [	2.29E-08	x	250	x	25	x	1	x	3470	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	6.94E-07	= [	6.54E-08	x	250	x	25	x	1	x	3470	] / [	80	x	25,550	]
Arsenic	7.60E-07	= [	7.16E-08	x	250	x	25	x	1	x	3470	] / [	80	x	25,550	]
Chromium	na	= [	na	x	250	x	25	x	1	x	3470	] / [	80	x	25,550	]
NONCARCINOGENIC EFFECTS																
Carbazole	3.89E-08	= [	1.31E-09	x	250	x	25	x	1	x	3470	] / [	80	x	9,125	]
Benz(a)anthracene	2.09E-06	= [	7.04E-08	x	250	x	25	x	1	x	3470	] / [	80	x	9,125	]
Benzo(a)pyrene	2.35E-06	= [	7.91E-08	x	250	x	25	x	1	x	3470	] / [	80	x	9,125	]
Benzo(b)fluoranthene	3.93E-06	= [	1.32E-07	x	250	x	25	x	1	x	3470	] / [	80	x	9,125	]
Chrysene	3.32E-06	= [	1.12E-07	x	250	x	25	x	1	x	3470	] / [	80	x	9,125	]
Dibenz(a,h)anthracene	6.81E-07	= [	2.29E-08	x	250	x	25	x	1	x	3470	] / [	80	x	9,125	]
Indeno(1,2,3-cd)pyrene	1.94E-06	= [	6.54E-08	x	250	x	25	x	1	x	3470	] / [	80	x	9,125	]
Arsenic	2.13E-06	= [	7.16E-08	x	250	x	25	x	1	x	3470	] / [	80	x	9,125	]
Chromium	na	= [	na	x	250	x	25	x	1	x	3470	] / [	80	x	9,125	]

DAD = dermal absorbed dose (mg/kg-day)
DA_{event} = absorbed dose per event (mg/cm^2-event)
EF = exposure frequency (days/year)
ED = exposure duration (years)
EV = event frequency (events/day)
SA = skin surface area available for contact (cm^2)
BW = body weight
AT = averaging time

Table B1.34
SMA 4, Surface Soil, 0 - 1 ft, Daily Intake Calculations: Construction Worker
Dermal Contact with Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	DAD	= [	DA_{event}	x	EF	x	ED	x	EV	x	SA	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/cm^2-event**		**days/year**		**years**		**events/day**		**cm^2**		**kg**		**days**	
CARCINOGENIC EFFECTS																
Carbazole	7.99E-11	= [	1.31E-09	x	36	x	1	x	1	x	3470	] / [	80	x	25,550	]
Benz(a)anthracene	4.30E-09	= [	7.04E-08	x	36	x	1	x	1	x	3470	] / [	80	x	25,550	]
Benzo(a)pyrene	4.83E-09	= [	7.91E-08	x	36	x	1	x	1	x	3470	] / [	80	x	25,550	]
Benzo(b)fluoranthene	8.08E-09	= [	1.32E-07	x	36	x	1	x	1	x	3470	] / [	80	x	25,550	]
Chrysene	6.83E-09	= [	1.12E-07	x	36	x	1	x	1	x	3470	] / [	80	x	25,550	]
Dibenz(a,h)anthracene	1.40E-09	= [	2.29E-08	x	36	x	1	x	1	x	3470	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	4.00E-09	= [	6.54E-08	x	36	x	1	x	1	x	3470	] / [	80	x	25,550	]
Arsenic	4.38E-09	= [	7.16E-08	x	36	x	1	x	1	x	3470	] / [	80	x	25,550	]
Chromium	na	= [	na	x	36	x	1	x	1	x	3470	] / [	80	x	25,550	]
NONCARCINOGENIC EFFECTS																
Carbazole	5.60E-09	= [	1.31E-09	x	36	x	1	x	1	x	3470	] / [	80	x	365	]
Benz(a)anthracene	3.01E-07	= [	7.04E-08	x	36	x	1	x	1	x	3470	] / [	80	x	365	]
Benzo(a)pyrene	3.38E-07	= [	7.91E-08	x	36	x	1	x	1	x	3470	] / [	80	x	365	]
Benzo(b)fluoranthene	5.66E-07	= [	1.32E-07	x	36	x	1	x	1	x	3470	] / [	80	x	365	]
Chrysene	4.78E-07	= [	1.12E-07	x	36	x	1	x	1	x	3470	] / [	80	x	365	]
Dibenz(a,h)anthracene	9.80E-08	= [	2.29E-08	x	36	x	1	x	1	x	3470	] / [	80	x	365	]
Indeno(1,2,3-cd)pyrene	2.80E-07	= [	6.54E-08	x	36	x	1	x	1	x	3470	] / [	80	x	365	]
Arsenic	3.06E-07	= [	7.16E-08	x	36	x	1	x	1	x	3470	] / [	80	x	365	]
Chromium	na	= [	na	x	36	x	1	x	1	x	3470	] / [	80	x	365	]

DAD = dermal absorbed dose (mg/kg-day)
DA_{event} = absorbed dose per event (mg/cm^2-event)
EF = exposure frequency (days/year)
ED = exposure duration (years)
EV = event frequency (events/day)
SA = skin surface area available for contact (cm^2)
BW = body weight
AT = averaging time

Table B1.35
SMA 4, Surface Soil 0 - 1 ft - Daily Intake Calculations: Adolescent Trespasser
Dermal Contact with Chemicals in Soil 0 - 1 ft
ERP Coke Facility, Birmingham, AL

Equation	DAD = [	DA_{event}	x	EF	x	ED	x	EV	x	SA] / [	BW	x	AT]
Units	**mg/kg-day**	**mg/cm^2-event**		**days/year**		**years**		**events/day**		**cm^2**	**kg**		**days**
CARCINOGENIC EFFECTS													
Carbazole	1.22E-09 = [	2.18E-09	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Benz(a)anthracene	6.56E-08 = [	1.17E-07	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Benzo(a)pyrene	7.37E-08 = [	1.32E-07	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Benzo(b)fluoranthene	1.23E-07 = [	2.20E-07	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Chrysene	1.04E-07 = [	1.86E-07	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Dibenz(a,h)anthracene	2.14E-08 = [	3.82E-08	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Indeno(1,2,3-cd)pyrene	6.10E-08 = [	1.09E-07	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Naphthalene	6.44E-08 = [	1.15E-07	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Aluminum	na = [	na	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Arsenic	6.67E-08 = [	1.19E-07	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Chromium	na = [	na	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Cobalt	na = [	na	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Manganese	na = [	na	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
Vanadium	na = [	na	x	12	x	10	x	1	x	5595] / [	47	x	25,550]
NONCARCINOGENIC EFFECTS													
Carbazole	8.53E-09 = [	2.18E-09	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Benz(a)anthracene	4.59E-07 = [	1.17E-07	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Benzo(a)pyrene	5.16E-07 = [	1.32E-07	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Benzo(b)fluoranthene	8.63E-07 = [	2.20E-07	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Chrysene	7.29E-07 = [	1.86E-07	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Dibenz(a,h)anthracene	1.49E-07 = [	3.82E-08	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Indeno(1,2,3-cd)pyrene	4.27E-07 = [	1.09E-07	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Naphthalene	4.51E-07 = [	1.15E-07	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Aluminum	na = [	na	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Arsenic	4.67E-07 = [	1.19E-07	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Chromium	na = [	na	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Cobalt	na = [	na	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Manganese	na = [	na	x	12	x	10	x	1	x	5595] / [	47	x	3,650]
Vanadium	na = [	na	x	12	x	10	x	1	x	5595] / [	47	x	3,650]

DAD = dermal absorbed dose (mg/kg-day)
DA_{event} = absorbed dose per event (mg/cm^2-event)
EF = exposure frequency (days/year)
ED = exposure duration (years)
EV = event frequency (events/day)
SA = skin surface area available for contact (cm^2)
BW = body weight
AT = averaging time

Table B1.36
SMA 4, Surface Soil, 2 - 15 ft, Daily Intake Calculations: Industrial/Commercial Worker
Dermal Contact with Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	DAD	= [	DA_{event}	x	EF	x	ED	x	EV	x	SA	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/cm²-event**		**days/year**		**years**		**events/day**		**cm²**		**kg**		**days**	
CARCINOGENIC EFFECTS																
1,1,2-Trichloroethane	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Benzene	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Chlorobenzene	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Ethylbenzene	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Toluene	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Vinyl chloride	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Xylenes	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Benzo(a)anthracene	1.79E-08	= [	8.46E-08	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Benzo(a)pyrene	1.50E-08	= [	7.08E-08	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Benzo(b)fluoranthene	2.08E-08	= [	9.79E-08	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Benzo(k)fluoranthene	4.84E-09	= [	2.28E-08	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Carbazole	4.97E-09	= [	2.34E-08	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Chrysene	1.62E-08	= [	7.65E-08	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Dibenzo(a,h)anthracene	1.59E-09	= [	7.47E-09	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	4.57E-09	= [	2.15E-08	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Naphthalene	2.66E-07	= [	1.26E-06	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Arsenic	7.54E-09	= [	3.55E-08	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
Chromium	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	25,550	]
NONCARCINOGENIC EFFECTS																
1,1,2-Trichloroethane	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Benzene	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Chlorobenzene	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Ethylbenzene	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Toluene	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Vinyl chloride	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Xylenes	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Benzo(a)anthracene	5.02E-08	= [	8.46E-08	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Benzo(a)pyrene	4.20E-08	= [	7.08E-08	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Benzo(b)fluoranthene	5.82E-08	= [	9.79E-08	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Benzo(k)fluoranthene	1.36E-08	= [	2.28E-08	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Carbazole	1.39E-08	= [	2.34E-08	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Chrysene	4.55E-08	= [	7.65E-08	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Dibenzo(a,h)anthracene	4.44E-09	= [	7.47E-09	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Indeno(1,2,3-cd)pyrene	1.28E-08	= [	2.15E-08	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Naphthalene	7.46E-07	= [	1.26E-06	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Arsenic	2.11E-08	= [	3.55E-08	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]
Chromium	na	= [	na	x	5	x	25	x	1	x	3470	] / [	80	x	9,125	]

DAD = dermal absorbed dose (mg/kg-day)
DA_{event} = absorbed dose per event (mg/cm²-event)
EF = exposure frequency (days/year)
ED = exposure duration (years)
EV = event frequency (events/day)
SA = skin surface area available for contact (cm²)
BW = body weight
AT = averaging time

Table B1.37
SMA 4, Subsurface Soil, 2 - 15 ft, Daily Intake Calculations: Construction Worker
Dermal Contact with Chemicals in Soil
ERP Coke Facility, Birmingham, AL

Equation	DAD	= [	DA_{event}	x	EF	x	ED	x	EV	x	SA	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/cm^2-event**		**days/year**		**years**		**events/day**		**cm^2**		**kg**		**days**	
CARCINOGENIC EFFECTS																
1,1,2-Trichloroethane	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Benzene	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Chlorobenzene	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Ethylbenzene	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Toluene	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Vinyl chloride	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Xylenes	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Benzo(a)anthracene	3.59E-08	= [	8.46E-08	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Benzo(a)pyrene	3.00E-08	= [	7.08E-08	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Benzo(b)fluoranthene	4.15E-08	= [	9.79E-08	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Benzo(k)fluoranthene	9.68E-09	= [	2.28E-08	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Carbazole	9.94E-09	= [	2.34E-08	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Chrysene	3.25E-08	= [	7.65E-08	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Dibenzo(a,h)anthracene	3.17E-09	= [	7.47E-09	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	9.14E-09	= [	2.15E-08	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Naphthalene	5.33E-07	= [	1.26E-06	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Arsenic	1.51E-08	= [	3.55E-08	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
Chromium	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	25,550	]
NONCARCINOGENIC EFFECTS																
1,1,2-Trichloroethane	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Benzene	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Chlorobenzene	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Ethylbenzene	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Toluene	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Vinyl chloride	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Xylenes	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Benzo(a)anthracene	2.51E-06	= [	8.46E-08	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Benzo(a)pyrene	2.10E-06	= [	7.08E-08	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Benzo(b)fluoranthene	2.91E-06	= [	9.79E-08	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Benzo(k)fluoranthene	6.78E-07	= [	2.28E-08	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Carbazole	6.96E-07	= [	2.34E-08	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Chrysene	2.27E-06	= [	7.65E-08	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Dibenzo(a,h)anthracene	2.22E-07	= [	7.47E-09	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Indeno(1,2,3-cd)pyrene	6.40E-07	= [	2.15E-08	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Naphthalene	3.73E-05	= [	1.26E-06	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Arsenic	1.06E-06	= [	3.55E-08	x	250	x	1	x	1	x	3470	] / [	80	x	365	]
Chromium	na	= [	na	x	250	x	1	x	1	x	3470	] / [	80	x	365	]

DAD = dermal absorbed dose (mg/kg-day)
DA_{event} = absorbed dose per event (mg/cm^2-event)
EF = exposure frequency (days/year)
ED = exposure duration (years)
EV = event frequency (events/day)
SA = skin surface area available for contact (cm^2)
BW = body weight
AT = averaging time

Table B1.38
SMA 4, Mineral Wool Pile - Daily Intake Calculations: Industrial/Commercial Worker
Dermal Contact with Chemicals in the Mineral Wool
ERP Coke Facility, Birmingham, AL

Equation	DAD	= [	DA_{event}	x	EF	x	ED	x	EV	x	SA	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/cm²-event**		**days/year**		**years**		**events/day**		**cm²**		**kg**		**days**	
CARCINOGENIC EFFECTS																
Benzo(a)pyrene	2.48E-09	= [	1.62E-09	x	36	x	25	x	1	x	3470	] / [	80	x	25,550	]
Benzo(a)anthracene	2.41E-09	= [	1.58E-09	x	36	x	25	x	1	x	3470	] / [	80	x	25,550	]
Benzo(b)fluoranthene	1.94E-09	= [	1.27E-09	x	36	x	25	x	1	x	3470	] / [	80	x	25,550	]
Chrysene	2.09E-09	= [	1.37E-09	x	36	x	25	x	1	x	3470	] / [	80	x	25,550	]
Dibenz(a,h)anthracene	1.55E-09	= [	1.01E-09	x	36	x	25	x	1	x	3470	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	8.22E-10	= [	5.38E-10	x	36	x	25	x	1	x	3470	] / [	80	x	25,550	]
Carbazole	na	= [	2.28E-10	x	36	x	25	x	1	x	3470	] / [	80	x	25,550	]
Arsenic	1.33E-08	= [	8.70E-09	x	36	x	25	x	1	x	3470	] / [	80	x	25,550	]
Chromium	na	= [	na	x	36	x	25	x	1	x	3470	] / [	80	x	25,550	]
NONCARCINOGENIC EFFECTS																
Benzo(a)pyrene	6.94E-09	= [	1.62E-09	x	36	x	25	x	1	x	3470	] / [	80	x	9,125	]
Benzo(a)anthracene	6.74E-09	= [	1.58E-09	x	36	x	25	x	1	x	3470	] / [	80	x	9,125	]
Benzo(b)fluoranthene	5.42E-09	= [	1.27E-09	x	36	x	25	x	1	x	3470	] / [	80	x	9,125	]
Chrysene	5.86E-09	= [	1.37E-09	x	36	x	25	x	1	x	3470	] / [	80	x	9,125	]
Dibenz(a,h)anthracene	4.34E-09	= [	1.01E-09	x	36	x	25	x	1	x	3470	] / [	80	x	9,125	]
Indeno(1,2,3-cd)pyrene	2.30E-09	= [	5.38E-10	x	36	x	25	x	1	x	3470	] / [	80	x	9,125	]
Carbazole	na	= [	2.28E-10	x	36	x	25	x	1	x	3470	] / [	80	x	9,125	]
Arsenic	3.72E-08	= [	8.70E-09	x	36	x	25	x	1	x	3470	] / [	80	x	9,125	]
Chromium	na	= [	na	x	36	x	25	x	1	x	3470	] / [	80	x	9,125	]

DAD = dermal absorbed dose (mg/kg-day)
DA_{event} = absorbed dose per event (mg/cm²-event)
EF = exposure frequency (days/year)
ED = exposure duration (years)
EV = event frequency (events/day)
SA = skin surface area available for contact (cm²)
BW = body weight
AT = averaging time
na = not applicable

Table B2.1
SMA 4 On-site Groundwater - Daily Intake Calculations: Industrial/Commercial Worker
Ingestion of Chemicals in Groundwater
ERP Coke Facility, Birmingham, AL

Equation	$DI_{ingestion}$	= [	CW	x	IR	x	EF	x	ED	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/L**		**L/day**		**days/year**		**years**		**kg**		**days**	
CARCINOGENIC EFFECTS														
Vinylchloride	2.42E-04	= [	7.92E-02	x	1	x	250	x	25	] / [	80	x	25,550	]
Acetone	4.58E-03	= [	1.50E+00	x	1	x	250	x	25	] / [	80	x	25,550	]
Methylene chloride	2.68E-04	= [	8.75E-02	x	1	x	250	x	25	] / [	80	x	25,550	]
cis-1,2-Dichloroethene	1.67E-04	= [	5.46E-02	x	1	x	250	x	25	] / [	80	x	25,550	]
Benzene	5.51E-02	= [	1.80E+01	x	1	x	250	x	25	] / [	80	x	25,550	]
1,2-Dichloroethane	2.29E-04	= [	7.50E-02	x	1	x	250	x	25	] / [	80	x	25,550	]
Trichloroethene	3.80E-06	= [	1.24E-03	x	1	x	250	x	25	] / [	80	x	25,550	]
Toluene	4.36E-02	= [	1.43E+01	x	1	x	250	x	25	] / [	80	x	25,550	]
Chlorobenzene	1.36E-01	= [	4.44E+01	x	1	x	250	x	25	] / [	80	x	25,550	]
Ethylbenzene	1.35E-06	= [	4.40E-04	x	1	x	250	x	25	] / [	80	x	25,550	]
m,p-Xylenes	1.07E-04	= [	3.49E-02	x	1	x	250	x	25	] / [	80	x	25,550	]
Isopropylbenzene	2.47E-05	= [	8.06E-03	x	1	x	250	x	25	] / [	80	x	25,550	]
1,4-Dioxane	5.60E-06	= [	1.83E-03	x	1	x	250	x	25	] / [	80	x	25,550	]
Cyclohexane, Methyl-	5.27E-06	= [	1.72E-03	x	1	x	250	x	25	] / [	80	x	25,550	]
1,2,4-Trichlorobenzene	9.98E-05	= [	3.27E-02	x	1	x	250	x	25	] / [	80	x	25,550	]
1,3-Dichlorobenzene	6.46E-06	= [	2.11E-03	x	1	x	250	x	25	] / [	80	x	25,550	]
1,4-Dichlorobenzene	7.01E-04	= [	2.29E-01	x	1	x	250	x	25	] / [	80	x	25,550	]
2-Chlorophenol	1.91E-05	= [	6.23E-03	x	1	x	250	x	25	] / [	80	x	25,550	]
Acetophenone	2.29E-06	= [	7.48E-04	x	1	x	250	x	25	] / [	80	x	25,550	]
Carbazole	1.73E-06	= [	5.67E-04	x	1	x	250	x	25	] / [	80	x	25,550	]
Dibenzofuran	2.25E-06	= [	7.35E-04	x	1	x	250	x	25	] / [	80	x	25,550	]
Dimethyl phthalate	7.19E-07	= [	2.35E-04	x	1	x	250	x	25	] / [	80	x	25,550	]
Pentachlorophenol	6.42E-05	= [	2.10E-02	x	1	x	250	x	25	] / [	80	x	25,550	]
Naphthalene	2.33E-05	= [	7.62E-03	x	1	x	250	x	25	] / [	80	x	25,550	]
Benz(a)anthracene	2.68E-07	= [	8.76E-05	x	1	x	250	x	25	] / [	80	x	25,550	]
Benzo(a)pyrene	1.43E-07	= [	4.69E-05	x	1	x	250	x	25	] / [	80	x	25,550	]
Benzo(b)fluoranthene	1.90E-07	= [	6.21E-05	x	1	x	250	x	25	] / [	80	x	25,550	]
Chrysene	4.43E-07	= [	1.45E-04	x	1	x	250	x	25	] / [	80	x	25,550	]
Dibenz(a,h)anthracene	6.57E-08	= [	2.15E-05	x	1	x	250	x	25	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	1.29E-07	= [	4.21E-05	x	1	x	250	x	25	] / [	80	x	25,550	]

Table B2.1
SMA 4 On-site Groundwater - Daily Intake Calculations: Industrial/Commercial Worker
Ingestion of Chemicals in Groundwater
ERP Coke Facility, Birmingham, AL

Equation	$DI_{ingestion}$	= [	CW	x	IR	x	EF	x	ED	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/L**		**L/day**		**days/year**		**years**		**kg**		**days**	
NONCARCINOGENIC EFFECTS														
Vinylchloride	6.78E-04	= [	7.92E-02	x	1	x	250	x	25	] / [	80	x	9,125	]
Acetone	1.28E-02	= [	1.50E+00	x	1	x	250	x	25	] / [	80	x	9,125	]
Methylene chloride	7.49E-04	= [	8.75E-02	x	1	x	250	x	25	] / [	80	x	9,125	]
cis-1,2-Dichloroethene	4.68E-04	= [	5.46E-02	x	1	x	250	x	25	] / [	80	x	9,125	]
Benzene	1.54E-01	= [	1.80E+01	x	1	x	250	x	25	] / [	80	x	9,125	]
1,2-Dichloroethane	6.42E-04	= [	7.50E-02	x	1	x	250	x	25	] / [	80	x	9,125	]
Trichloroethene	1.06E-05	= [	1.24E-03	x	1	x	250	x	25	] / [	80	x	9,125	]
Toluene	1.22E-01	= [	1.43E+01	x	1	x	250	x	25	] / [	80	x	9,125	]
Chlorobenzene	3.80E-01	= [	4.44E+01	x	1	x	250	x	25	] / [	80	x	9,125	]
Ethylbenzene	3.77E-06	= [	4.40E-04	x	1	x	250	x	25	] / [	80	x	9,125	]
m,p-Xylenes	2.98E-04	= [	3.49E-02	x	1	x	250	x	25	] / [	80	x	9,125	]
Isopropylbenzene	6.90E-05	= [	8.06E-03	x	1	x	250	x	25	] / [	80	x	9,125	]
1,4-Dioxane	1.57E-05	= [	1.83E-03	x	1	x	250	x	25	] / [	80	x	9,125	]
Cyclohexane, Methyl-	1.48E-05	= [	1.72E-03	x	1	x	250	x	25	] / [	80	x	9,125	]
1,2,4-Trichlorobenzene	2.80E-04	= [	3.27E-02	x	1	x	250	x	25	] / [	80	x	9,125	]
1,3-Dichlorobenzene	1.81E-05	= [	2.11E-03	x	1	x	250	x	25	] / [	80	x	9,125	]
1,4-Dichlorobenzene	1.96E-03	= [	2.29E-01	x	1	x	250	x	25	] / [	80	x	9,125	]
2-Chlorophenol	5.34E-05	= [	6.23E-03	x	1	x	250	x	25	] / [	80	x	9,125	]
Acetophenone	6.40E-06	= [	7.48E-04	x	1	x	250	x	25	] / [	80	x	9,125	]
Carbazole	4.85E-06	= [	5.67E-04	x	1	x	250	x	25	] / [	80	x	9,125	]
Dibenzofuran	6.29E-06	= [	7.35E-04	x	1	x	250	x	25	] / [	80	x	9,125	]
Dimethyl phthalate	2.01E-06	= [	2.35E-04	x	1	x	250	x	25	] / [	80	x	9,125	]
Pentachlorophenol	1.80E-04	= [	2.10E-02	x	1	x	250	x	25	] / [	80	x	9,125	]
Naphthalene	6.53E-05	= [	7.62E-03	x	1	x	250	x	25	] / [	80	x	9,125	]
Benz(a)anthracene	7.50E-07	= [	8.76E-05	x	1	x	250	x	25	] / [	80	x	9,125	]
Benzo(a)pyrene	4.02E-07	= [	4.69E-05	x	1	x	250	x	25	] / [	80	x	9,125	]
Benzo(b)fluoranthene	5.32E-07	= [	6.21E-05	x	1	x	250	x	25	] / [	80	x	9,125	]
Chrysene	1.24E-06	= [	1.45E-04	x	1	x	250	x	25	] / [	80	x	9,125	]
Dibenz(a,h)anthracene	1.84E-07	= [	2.15E-05	x	1	x	250	x	25	] / [	80	x	9,125	]
Indeno(1,2,3-cd)pyrene	3.60E-07	= [	4.21E-05	x	1	x	250	x	25	] / [	80	x	9,125	]

nd = no data
na = not applicable
$DI_{ingestion}$ = daily chemical intake via groundwater ingestion
CW = chemical concentration in groundwater
IR = water ingestion rate
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

Table B2.2
SMA 4 On-site Groundwater - Dermal Contact with Chemicals in Groundwater
Concentration of Chemical in Shower Water After Volatilization (Cshw)
ERP Coke Facility, Birmingham, AL

Equation	Cshw	=	CW	x	f	x	CF
Units	**mg/cm^3**		**mg/L**		**unitless**		**L/cm3**
Vinylchloride	3.96E-05	=	7.92E-02	x	5.00E-01	x	1.00E-03
Acetone	7.50E-04	=	1.50E+00	x	5.00E-01	x	1.00E-03
Methylene chloride	4.38E-05	=	8.75E-02	x	5.00E-01	x	1.00E-03
cis-1,2-Dichloroethene	2.73E-05	=	5.46E-02	x	5.00E-01	x	1.00E-03
Benzene	9.00E-03	=	1.80E+01	x	5.00E-01	x	1.00E-03
1,2-Dichloroethane	3.75E-05	=	7.50E-02	x	5.00E-01	x	1.00E-03
Trichloroethene	6.21E-07	=	1.24E-03	x	5.00E-01	x	1.00E-03
Toluene	7.13E-03	=	1.43E+01	x	5.00E-01	x	1.00E-03
Chlorobenzene	2.22E-02	=	4.44E+01	x	5.00E-01	x	1.00E-03
Ethylbenzene	2.20E-07	=	4.40E-04	x	5.00E-01	x	1.00E-03
m,p-Xylenes	1.74E-05	=	3.49E-02	x	5.00E-01	x	1.00E-03
Isopropylbenzene	4.03E-06	=	8.06E-03	x	5.00E-01	x	1.00E-03
1,4-Dioxane	9.16E-07	=	1.83E-03	x	5.00E-01	x	1.00E-03
Cyclohexane, Methyl-	8.62E-07	=	1.72E-03	x	5.00E-01	x	1.00E-03
1,2,4-Trichlorobenzene	1.63E-05	=	3.27E-02	x	5.00E-01	x	1.00E-03
1,3-Dichlorobenzene	1.06E-06	=	2.11E-03	x	5.00E-01	x	1.00E-03
1,4-Dichlorobenzene	1.15E-04	=	2.29E-01	x	5.00E-01	x	1.00E-03
2-Chlorophenol	3.12E-06	=	6.23E-03	x	5.00E-01	x	1.00E-03
Acetophenone	3.74E-07	=	7.48E-04	x	5.00E-01	x	1.00E-03
Carbazole	2.84E-07	=	5.67E-04	x	5.00E-01	x	1.00E-03
Dibenzofuran	3.68E-07	=	7.35E-04	x	5.00E-01	x	1.00E-03
Dimethyl phthalate	1.18E-07	=	2.35E-04	x	5.00E-01	x	1.00E-03
Pentachlorophenol	2.10E-05	=	2.10E-02	x	1.00E+00	x	1.00E-03
Naphthalene	3.81E-06	=	7.62E-03	x	5.00E-01	x	1.00E-03
Benz(a)anthracene	8.76E-08	=	8.76E-05	x	1.00E+00	x	1.00E-03
Benzo(a)pyrene	4.69E-08	=	4.69E-05	x	1.00E+00	x	1.00E-03
Benzo(b)fluoranthene	6.21E-08	=	6.21E-05	x	1.00E+00	x	1.00E-03
Chrysene	1.45E-07	=	1.45E-04	x	1.00E+00	x	1.00E-03
Dibenz(a,h)anthracene	2.15E-08	=	2.15E-05	x	1.00E+00	x	1.00E-03
Indeno(1,2,3-cd)pyrene	4.21E-08	=	4.21E-05	x	1.00E+00	x	1.00E-03

CW = concentration of chemical in groundwater
f = fraction of chemical in water after volatilization; 0.5 for volatile organics,
1.0 for semivolatile organics
CF = conversion factor

Table B2.3
SMA 4 On-site Groundwater
Absorbed Chemical Dose While Showering - Organic Chemicals
ERP Coke Facility, Birmingham, AL

Equation	DA_{event}	=	Cshw	x	Kp	x	2	x	FA	x	SQRT	(	(	6	x	tau	x	t_{event}	)	/	π	)	)
Units	**mg/kg-event**		**mg/cm^3**		**cm/hr**				**unitless**							hr		hr					
Vinylchloride	3.96E-07	=	3.96E-05	x	8.38E-03	x	2	x	1.0	x	SQRT	(	(	6	x	0.57	x	0.33	)	/	3.1	)	)
Acetone	4.45E-07	=	7.50E-04	x	5.12E-04	x	2	x	1.0	x	SQRT	(	(	6	x	0.53	x	0.33	)	/	3.1	)	)
Methylene chloride	2.14E-07	=	4.38E-05	x	3.54E-03	x	2	x	1.0	x	SQRT	(	(	6	x	0.75	x	0.33	)	/	3.1	)	)
cis-1,2-Dichloroethene	4.48E-07	=	2.73E-05	x	1.10E-02	x	2	x	1.0	x	SQRT	(	(	6	x	0.88	x	0.33	)	/	3.1	)	)
Benzene	1.77E-04	=	9.00E-03	x	1.49E-02	x	2	x	1.0	x	SQRT	(	(	6	x	0.69	x	0.33	)	/	3.1	)	)
1,2-Dichloroethane	2.38E-07	=	3.75E-05	x	4.20E-03	x	2	x	1.0	x	SQRT	(	(	6	x	0.9	x	0.33	)	/	3.1	)	)
Trichloroethene	1.34E-08	=	6.21E-07	x	1.16E-02	x	2	x	1.0	x	SQRT	(	(	6	x	1.37	x	0.33	)	/	3.1	)	)
Toluene	3.20E-04	=	7.13E-03	x	3.11E-02	x	2	x	1.0	x	SQRT	(	(	6	x	0.83	x	0.33	)	/	3.1	)	)
Chlorobenzene	1.03E-03	=	2.22E-02	x	2.82E-02	x	2	x	1.0	x	SQRT	(	(	6	x	1.08	x	0.33	)	/	3.1	)	)
Ethylbenzene	1.72E-08	=	2.20E-07	x	4.93E-02	x	2	x	1.0	x	SQRT	(	(	6	x	0.99	x	0.33	)	/	3.1	)	)
m,p-Xylenes	1.47E-06	=	1.74E-05	x	5.32E-02	x	2	x	1.0	x	SQRT	(	(	6	x	0.99	x	0.33	)	/	3.1	)	)
Isopropylbenzene	na	=	4.03E-06	x	nd	x	2	x	1.0	x	SQRT	(	(	6	x	nd	x	0.33	)	/	3.1	)	)
1,4-Dioxane	4.28E-10	=	9.16E-07	x	3.32E-04	x	2	x	1.0	x	SQRT	(	(	6	x	0.79	x	0.33	)	/	3.1	)	)
Cyclohexane, Methyl-	na	=	8.62E-07	x	nd	x	2	x	1.0	x	SQRT	(	(	6	x	nd	x	0.33	)	/	3.1	)	)
1,2,4-Trichlorobenzene	2.96E-06	=	1.63E-05	x	7.05E-02	x	2	x	1.0	x	SQRT	(	(	6	x	2.62	x	0.33	)	/	3.1	)	)
1,3-Dichlorobenzene	na	=	1.06E-06	x	nd	x	2	x	1.0	x	SQRT	(	(	6	x	nd	x	0.33	)	/	3.1	)	)
1,4-Dichlorobenzene	1.07E-05	=	1.15E-04	x	4.53E-02	x	2	x	1.0	x	SQRT	(	(	6	x	1.68	x	0.33	)	/	3.1	)	)
2-Chlorophenol	4.55E-08	=	3.12E-06	x	7.99E-03	x	2	x	1.0	x	SQRT	(	(	6	x	1.32	x	0.33	)	/	3.1	)	)
Acetophenone	2.41E-09	=	3.74E-07	x	3.72E-03	x	2	x	1.0	x	SQRT	(	(	6	x	1.19	x	0.33	)	/	3.1	)	)
Carbazole	na	=	2.84E-07	x	nd	x	2	x	1.0	x	SQRT	(	(	6	x	nd	x	0.33	)	/	3.1	)	)
Dibenzofuran	8.46E-08	=	3.68E-07	x	9.75E-02	x	2	x	1.0	x	SQRT	(	(	6	x	2.21	x	0.33	)	/	3.1	)	)
Dimethyl phthalate	na	=	1.18E-07	x	nd	x	2	x	1.0	x	SQRT	(	(	6	x	nd	x	0.33	)	/	3.1	)	)
Pentachlorophenol	1.50E-05	=	2.10E-05	x	1.27E-01	x	2	x	1.0	x	SQRT	(	(	6	x	12.5	x	0.33	)	/	3.1	)	)
Naphthalene	3.24E-07	=	3.81E-06	x	4.66E-02	x	2	x	1.0	x	SQRT	(	(	6	x	1.32	x	0.33	)	/	3.1	)	)
Benz(a)anthracene	2.24E-07	=	8.76E-08	x	5.52E-01	x	2	x	1.0	x	SQRT	(	(	6	x	8.48	x	0.33	)	/	3.1	)	)
Benzo(a)pyrene	1.83E-07	=	4.69E-08	x	7.13E-01	x	2	x	1.0	x	SQRT	(	(	6	x	11.8	x	0.33	)	/	3.1	)	)
Benzo(b)fluoranthene	1.39E-07	=	6.21E-08	x	4.17E-01	x	2	x	1.0	x	SQRT	(	(	6	x	11.3	x	0.33	)	/	3.1	)	)
Chrysene	4.01E-07	=	1.45E-07	x	5.96E-01	x	2	x	1.0	x	SQRT	(	(	6	x	8.53	x	0.33	)	/	3.1	)	)
Dibenz(a,h)anthracene	1.34E-07	=	2.15E-08	x	9.53E-01	x	2	x	1.0	x	SQRT	(	(	6	x	16.9	x	0.33	)	/	3.1	)	)
Indeno(1,2,3-cd)pyrene	3.38E-07	=	4.21E-08	x	1.24E+00	x	2	x	1.0	x	SQRT	(	(	6	x	16.7	x	0.33	)	/	3.1	)	)

DA_{event} = absorbed dose per event
Cshw = chemical concentration remaining in shower water after volatilization
Kp = chemical dermal permeability coefficient in water; source USEPA Regional Screening Levels, Parameters Table
FA = fraction of chemical absorbed; source USEPA RAGS Part E, Supplemental Guidance for Dermal Risk Assessment, Exhibit B-3
SQRT = square root
tau = lag time per event; source USEPA, 2004, RAGS Part E, Exhibit B-3
t_{event} = exposure time in shower
π = pi

na = not applicable
nd = no data

Table B2.4
SMA 4 On-site Groundwater - Daily Intake Calculations: Industrial/Commercial Worker
Dermal Absorbed Dose of Chemicals in Groundwater While Showering
ERP Coke Facility, Birmingham, AL

Equation	DAD	= [	DA_{event}	x	EF	x	ED	x	EV	x	SA	] / [	BW	x	AT	]
Units	mg/kg-day		mg/cm^2-event		days/year		years		events/day		cm^2		kg		days	
CARCINOGENIC EFFECTS																
Vinylchloride	2.53E-05	= [	3.96E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Acetone	2.85E-05	= [	4.45E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Methylene chloride	1.37E-05	= [	2.14E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
cis-1,2-Dichloroethene	2.86E-05	= [	4.48E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Benzene	1.13E-02	= [	1.77E-04	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
1,2-Dichloroethane	1.52E-05	= [	2.38E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Trichloroethene	8.57E-07	= [	1.34E-08	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Toluene	2.05E-02	= [	3.20E-04	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Chlorobenzene	6.60E-02	= [	1.03E-03	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Ethylbenzene	1.10E-06	= [	1.72E-08	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
m,p-Xylenes	9.37E-05	= [	1.47E-06	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Isopropylbenzene	na	= [	na	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
1,4-Dioxane	2.74E-08	= [	4.28E-10	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Cyclohexane, Methyl-	na	= [	na	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
1,2,4-Trichlorobenzene	1.89E-04	= [	2.96E-06	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
1,3-Dichlorobenzene	na	= [	na	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
1,4-Dichlorobenzene	6.83E-04	= [	1.07E-05	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
2-Chlorophenol	2.91E-06	= [	4.55E-08	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Acetophenone	1.54E-07	= [	2.41E-09	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Carbazole	na	= [	na	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Dibenzofuran	5.40E-06	= [	8.46E-08	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Dimethyl phthalate	na	= [	na	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Pentachlorophenol	9.59E-04	= [	1.50E-05	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Naphthalene	2.07E-05	= [	3.24E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Benz(a)anthracene	1.43E-05	= [	2.24E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Benzo(a)pyrene	1.17E-05	= [	1.83E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Benzo(b)fluoranthene	8.85E-06	= [	1.39E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Chrysene	2.56E-05	= [	4.01E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Dibenz(a,h)anthracene	8.54E-06	= [	1.34E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	2.16E-05	= [	3.38E-07	x	250	x	25	x	1	x	20900	] / [	80	x	25,550	]

Table B2.4
SMA 4 On-site Groundwater - Daily Intake Calculations: Industrial/Commercial Worker
Dermal Absorbed Dose of Chemicals in Groundwater While Showering
ERP Coke Facility, Birmingham, AL

Equation	DAD	= [	DA_{event}	x	EF	x	ED	x	EV	x	SA	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/cm^2-event**		**days/year**		**years**		**events/day**		**cm^2**		**kg**		**days**	
NONCARCINOGENIC EFFECTS																
Vinylchloride	7.09E-05	= [	3.96E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Acetone	7.97E-05	= [	4.45E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Methylene chloride	3.82E-05	= [	2.14E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
cis-1,2-Dichloroethene	8.01E-05	= [	4.48E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Benzene	3.17E-02	= [	1.77E-04	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
1,2-Dichloroethane	4.26E-05	= [	2.38E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Trichloroethene	2.40E-06	= [	1.34E-08	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Toluene	5.73E-02	= [	3.20E-04	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Chlorobenzene	1.85E-01	= [	1.03E-03	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Ethylbenzene	3.07E-06	= [	1.72E-08	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
m,p-Xylenes	2.62E-04	= [	1.47E-06	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Isopropylbenzene	na	= [	na	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
1,4-Dioxane	7.66E-08	= [	4.28E-10	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Cyclohexane, Methyl-	na	= [	na	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
1,2,4-Trichlorobenzene	5.29E-04	= [	2.96E-06	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
1,3-Dichlorobenzene	na	= [	na	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
1,4-Dichlorobenzene	1.91E-03	= [	1.07E-05	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
2-Chlorophenol	8.14E-06	= [	4.55E-08	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Acetophenone	4.31E-07	= [	2.41E-09	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Carbazole	na	= [	na	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Dibenzofuran	1.51E-05	= [	8.46E-08	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Dimethyl phthalate	na	= [	na	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Pentachlorophenol	2.68E-03	= [	1.50E-05	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Naphthalene	5.79E-05	= [	3.24E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Benz(a)anthracene	4.00E-05	= [	2.24E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Benzo(a)pyrene	3.27E-05	= [	1.83E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Benzo(b)fluoranthene	2.48E-05	= [	1.39E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Chrysene	7.17E-05	= [	4.01E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Dibenz(a,h)anthracene	2.39E-05	= [	1.34E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]
Indeno(1,2,3-cd)pyrene	6.05E-05	= [	3.38E-07	x	250	x	25	x	1	x	20900	] / [	80	x	9,125	]

na = not applicable
DAD = average daily absorbed chemical dose (mg/kg-day)
DA_{event} = absorbed dose per event (mg/cm^2-event)
EF = exposure frequency (days/year)
ED = exposure duration (years)
EV = event frequency (events/day)
SA = skin surface area available for contact (cm^2)
BW = body weight
AT = averaging time

Table B2.5
SMA 4 On-site Groundwater - Daily Intake Calculations: Future Construction Workers
Dermal Absorbed Dose of Chemicals in Groundwater During Trenching Activities
ERP Coke Facility, Birmingham, AL

Equation	DAD	= [	CW	x	SA	x	Kp	x	ET	x	EF	x	ED	x	CF	] / [	BW	x	AT	]
Units	mg/kg-day		mg/L		cm^2		cm/hr		hr/day		days/year		years		L/cm^3		kg		days	
CARCINOGENIC EFFECTS																				
Vinylchloride	2.82E-07	= [	7.92E-02	x	3470	x	8.380E-03	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Acetone	3.26E-07	= [	1.50E+00	x	3470	x	5.120E-04	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Methylene chloride	1.32E-07	= [	8.75E-02	x	3470	x	3.540E-03	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
cis-1,2-Dichloroethene	2.55E-07	= [	5.46E-02	x	3470	x	1.100E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Benzene	1.14E-04	= [	1.80E+01	x	3470	x	1.490E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
1,2-Dichloroethane	1.34E-07	= [	7.50E-02	x	3470	x	4.200E-03	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Trichloroethene	6.11E-09	= [	1.24E-03	x	3470	x	1.160E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Toluene	1.88E-04	= [	1.43E+01	x	3470	x	3.110E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Chlorobenzene	5.32E-04	= [	4.44E+01	x	3470	x	2.820E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Ethylbenzene	9.20E-09	= [	4.40E-04	x	3470	x	4.930E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
m,p-Xylenes	7.87E-07	= [	3.49E-02	x	3470	x	5.320E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Isopropylbenzene	na	= [	8.06E-03	x	3470	x	nd	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
1,4-Dioxane	2.58E-10	= [	1.83E-03	x	3470	x	3.320E-04	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Cyclohexane, Methyl-	na	= [	1.72E-03	x	3470	x	nd	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
1,2,4-Trichlorobenzene	9.77E-07	= [	3.27E-02	x	3470	x	7.050E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
1,3-Dichlorobenzene	na	= [	2.11E-03	x	3470	x	nd	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
1,4-Dichlorobenzene	4.41E-06	= [	2.29E-01	x	3470	x	4.530E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
2-Chlorophenol	2.11E-08	= [	6.23E-03	x	3470	x	7.990E-03	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Acetophenone	1.18E-09	= [	7.48E-04	x	3470	x	3.720E-03	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Carbazole	na	= [	5.67E-04	x	3470	x	nd	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Dibenzofuran	3.04E-08	= [	7.35E-04	x	3470	x	9.750E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Dimethyl phthalate	na	= [	2.35E-04	x	3470	x	nd	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Pentachlorophenol	1.13E-06	= [	2.10E-02	x	3470	x	1.270E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Naphthalene	1.51E-07	= [	7.62E-03	x	3470	x	4.660E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Benz(a)anthracene	2.05E-08	= [	8.76E-05	x	3470	x	5.520E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Benzo(a)pyrene	1.42E-08	= [	4.69E-05	x	3470	x	7.130E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Benzo(b)fluoranthene	1.10E-08	= [	6.21E-05	x	3470	x	4.170E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Chrysene	3.67E-08	= [	1.45E-04	x	3470	x	5.960E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Dibenz(a,h)anthracene	8.70E-09	= [	2.15E-05	x	3470	x	9.530E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]
Indeno(1,2,3-cd)pyrene	2.22E-08	= [	4.21E-05	x	3470	x	1.240E+00	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	25,550	]

Table B2.5
SMA 4 On-site Groundwater - Daily Intake Calculations: Future Construction Workers
Dermal Absorbed Dose of Chemicals in Groundwater During Trenching Activities
ERP Coke Facility, Birmingham, AL

Equation	DAD	= [	CW	x	SA	x	Kp	x	ET	x	EF	x	ED	x	CF	] / [	BW	x	AT	]
Units	**mg/kg-day**		**mg/L**		**cm^2**		**cm/hr**		**hr/day**		**days/year**		**years**		**L/cm^3**		**kg**		**days**	
NONCARCINOGENIC EFFECTS																				
Vinylchloride	1.97E-05	= [	7.92E-02	x	3470	x	8.380E-03	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Acetone	2.28E-05	= [	1.50E+00	x	3470	x	5.120E-04	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Methylene chloride	9.21E-06	= [	8.75E-02	x	3470	x	3.540E-03	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
cis-1,2-Dichloroethene	1.79E-05	= [	5.46E-02	x	3470	x	1.100E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Benzene	7.97E-03	= [	1.80E+01	x	3470	x	1.490E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
1,2-Dichloroethane	9.36E-06	= [	7.50E-02	x	3470	x	4.200E-03	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Trichloroethene	4.28E-07	= [	1.24E-03	x	3470	x	1.160E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Toluene	1.32E-02	= [	1.43E+01	x	3470	x	3.110E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Chlorobenzene	3.72E-02	= [	4.44E+01	x	3470	x	2.820E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Ethylbenzene	6.44E-07	= [	4.40E-04	x	3470	x	4.930E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
m,p-Xylenes	5.51E-05	= [	3.49E-02	x	3470	x	5.320E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Isopropylbenzene	na	= [	8.06E-03	x	3470	x	nd	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
1,4-Dioxane	1.81E-08	= [	1.83E-03	x	3470	x	3.320E-04	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Cyclohexane, Methyl-	na	= [	1.72E-03	x	3470	x	nd	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
1,2,4-Trichlorobenzene	6.84E-05	= [	3.27E-02	x	3470	x	7.050E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
1,3-Dichlorobenzene	na	= [	2.11E-03	x	3470	x	nd	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
1,4-Dichlorobenzene	3.08E-04	= [	2.29E-01	x	3470	x	4.530E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
2-Chlorophenol	1.48E-06	= [	6.23E-03	x	3470	x	7.990E-03	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Acetophenone	8.27E-08	= [	7.48E-04	x	3470	x	3.720E-03	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Carbazole	na	= [	5.67E-04	x	3470	x	nd	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Dibenzofuran	2.13E-06	= [	7.35E-04	x	3470	x	9.750E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Dimethyl phthalate	na	= [	2.35E-04	x	3470	x	nd	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Pentachlorophenol	7.92E-05	= [	2.10E-02	x	3470	x	1.270E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Naphthalene	1.06E-05	= [	7.62E-03	x	3470	x	4.660E-02	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Benz(a)anthracene	1.44E-06	= [	8.76E-05	x	3470	x	5.520E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Benzo(a)pyrene	9.93E-07	= [	4.69E-05	x	3470	x	7.130E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Benzo(b)fluoranthene	7.69E-07	= [	6.21E-05	x	3470	x	4.170E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Chrysene	2.57E-06	= [	1.45E-04	x	3470	x	5.960E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Dibenz(a,h)anthracene	6.09E-07	= [	2.15E-05	x	3470	x	9.530E-01	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]
Indeno(1,2,3-cd)pyrene	1.55E-06	= [	4.21E-05	x	3470	x	1.240E+00	x	2	x	125	x	1	x	1.00E-03	] / [	80	x	365	]

nd = no data
na = not applicable
DAD = average daily absorbed chemical dose (mg/kg-day)
DA_{event} = absorbed dose per event (mg/cm^2-event)
EF = exposure frequency (days/year)
ED = exposure duration (years)
EV = event frequency (events/day)
SA = skin surface area available for contact (cm^2)
BW = body weight
AT = averaging time

Table B2.6
SMA 4 On-site Groundwater - Industrial/Commercial Worker
Maximum Chemical Concentration in Air While Showering
ERP Coke Facility, Birmingham, AL

Equation	CA_{max}	=	CW	x	f	x	Fw	x	t1	x (1 / Va)
Units	µg/m^3		µg/L		unitless		L/hr		hr	m^3
Vinylchloride	1.09E+03	=	7.92E+01	x	0.5	x	1000	x	0.33	x (1 / 12)
Acetone	2.06E+04	=	1.50E+03	x	0.5	x	1000	x	0.33	x (1 / 12)
Methylene chloride	1.20E+03	=	8.75E+01	x	0.5	x	1000	x	0.33	x (1 / 12)
cis-1,2-Dichloroethene	7.51E+02	=	5.46E+01	x	0.5	x	1000	x	0.33	x (1 / 12)
Benzene	2.48E+05	=	1.80E+04	x	0.5	x	1000	x	0.33	x (1 / 12)
1,2-Dichloroethane	1.03E+03	=	7.50E+01	x	0.5	x	1000	x	0.33	x (1 / 12)
Trichloroethene	1.71E+01	=	1.24E+00	x	0.5	x	1000	x	0.33	x (1 / 12)
Toluene	1.96E+05	=	1.43E+04	x	0.5	x	1000	x	0.33	x (1 / 12)
Chlorobenzene	6.11E+05	=	4.44E+04	x	0.5	x	1000	x	0.33	x (1 / 12)
Ethylbenzene	6.05E+00	=	4.40E-01	x	0.5	x	1000	x	0.33	x (1 / 12)
m,p-Xylenes	4.79E+02	=	3.49E+01	x	0.5	x	1000	x	0.33	x (1 / 12)
Isopropylbenzene	1.11E+02	=	8.06E+00	x	0.5	x	1000	x	0.33	x (1 / 12)
1,4-Dioxane	2.52E+01	=	1.83E+00	x	0.5	x	1000	x	0.33	x (1 / 12)
Cyclohexane, Methyl-	2.37E+01	=	1.72E+00	x	0.5	x	1000	x	0.33	x (1 / 12)
1,2,4-Trichlorobenzene	4.49E+02	=	3.27E+01	x	0.5	x	1000	x	0.33	x (1 / 12)
1,3-Dichlorobenzene	2.91E+01	=	2.11E+00	x	0.5	x	1000	x	0.33	x (1 / 12)
1,4-Dichlorobenzene	3.15E+03	=	2.29E+02	x	0.5	x	1000	x	0.33	x (1 / 12)
2-Chlorophenol	8.57E+01	=	6.23E+00	x	0.5	x	1000	x	0.33	x (1 / 12)
Acetophenone	1.03E+01	=	7.48E-01	x	0.5	x	1000	x	0.33	x (1 / 12)
Carbazole	7.80E+00	=	5.67E-01	x	0.5	x	1000	x	0.33	x (1 / 12)
Dibenzofuran	1.01E+01	=	7.35E-01	x	0.5	x	1000	x	0.33	x (1 / 12)
Dimethyl phthalate	3.23E+00	=	2.35E-01	x	0.5	x	1000	x	0.33	x (1 / 12)
Pentachlorophenol	na	=	2.10E+01	x	na	x	1000	x	0.33	x (1 / 12)
Naphthalene	1.05E+02	=	7.62E+00	x	0.5	x	1000	x	0.33	x (1 / 12)
Benz(a)anthracene	na	=	8.76E-02	x	na	x	1000	x	0.33	x (1 / 12)
Benzo(a)pyrene	na	=	4.69E-02	x	na	x	1000	x	0.33	x (1 / 12)
Benzo(b)fluoranthene	na	=	6.21E-02	x	na	x	1000	x	0.33	x (1 / 12)
Chrysene	na	=	1.45E-01	x	na	x	1000	x	0.33	x (1 / 12)
Dibenz(a,h)anthracene	na	=	2.15E-02	x	na	x	1000	x	0.33	x (1 / 12)
Indeno(1,2,3-cd)pyrene	na	=	4.21E-02	x	na	x	1000	x	0.33	x (1 / 12)

CA_{max} = chemical concentration in air
CW = chemical concentration in groundwater
f = fraction volatilized, 0.5 for Volatile Organics
Fw = shower water flow rate
t1 = time of shower (20 minutes)
Va = bathroom volume
na = not applicable

Table B2.7
SMA 4 On-site Groundwater - Industrial/Commercial Worker
Chemical Concentration in Air While Showering
ERP Coke Facility, Birmingham, AL

Equation	CA	= [((	CA_{max}	/ 2) x	t1	) + (	CA_{max}	x	t2	)] / (	t1	+	t2	)
Units	**µg/m³**		**µg/m³**		**hr**		**µg/m³**		**hr**		**hr**		**hr**	
Vinylchloride	7.79E+02	= [((	1.09E+03	/ 2) x	0.33	) + (	1.09E+03		0.25	)] / (	0.33	+	0.25	)
Acetone	1.47E+04	= [((	2.06E+04	/ 2) x	0.33	) + (	2.06E+04		0.25	)] / (	0.33	+	0.25	)
Methylene chloride	8.61E+02	= [((	1.20E+03	/ 2) x	0.33	) + (	1.20E+03		0.25	)] / (	0.33	+	0.25	)
cis-1,2-Dichloroethene	5.37E+02	= [((	7.51E+02	/ 2) x	0.33	) + (	7.51E+02		0.25	)] / (	0.33	+	0.25	)
Benzene	1.77E+05	= [((	2.48E+05	/ 2) x	0.33	) + (	2.48E+05		0.25	)] / (	0.33	+	0.25	)
1,2-Dichloroethane	7.38E+02	= [((	1.03E+03	/ 2) x	0.33	) + (	1.03E+03		0.25	)] / (	0.33	+	0.25	)
Trichloroethene	1.22E+01	= [((	1.71E+01	/ 2) x	0.33	) + (	1.71E+01		0.25	)] / (	0.33	+	0.25	)
Toluene	1.40E+05	= [((	1.96E+05	/ 2) x	0.33	) + (	1.96E+05		0.25	)] / (	0.33	+	0.25	)
Chlorobenzene	4.37E+05	= [((	6.11E+05	/ 2) x	0.33	) + (	6.11E+05		0.25	)] / (	0.33	+	0.25	)
Ethylbenzene	4.33E+00	= [((	6.05E+00	/ 2) x	0.33	) + (	6.05E+00		0.25	)] / (	0.33	+	0.25	)
m,p-Xylenes	3.43E+02	= [((	4.79E+02	/ 2) x	0.33	) + (	4.79E+02		0.25	)] / (	0.33	+	0.25	)
Isopropylbenzene	7.93E+01	= [((	1.11E+02	/ 2) x	0.33	) + (	1.11E+02		0.25	)] / (	0.33	+	0.25	)
1,4-Dioxane	1.80E+01	= [((	2.52E+01	/ 2) x	0.33	) + (	2.52E+01		0.25	)] / (	0.33	+	0.25	)
Cyclohexane, Methyl-	1.70E+01	= [((	2.37E+01	/ 2) x	0.33	) + (	2.37E+01		0.25	)] / (	0.33	+	0.25	)
1,2,4-Trichlorobenzene	3.21E+02	= [((	4.49E+02	/ 2) x	0.33	) + (	4.49E+02		0.25	)] / (	0.33	+	0.25	)
1,3-Dichlorobenzene	2.08E+01	= [((	2.91E+01	/ 2) x	0.33	) + (	2.91E+01		0.25	)] / (	0.33	+	0.25	)
1,4-Dichlorobenzene	2.25E+03	= [((	3.15E+03	/ 2) x	0.33	) + (	3.15E+03		0.25	)] / (	0.33	+	0.25	)
2-Chlorophenol	6.13E+01	= [((	8.57E+01	/ 2) x	0.33	) + (	8.57E+01		0.25	)] / (	0.33	+	0.25	)
Acetophenone	7.36E+00	= [((	1.03E+01	/ 2) x	0.33	) + (	1.03E+01		0.25	)] / (	0.33	+	0.25	)
Carbazole	5.58E+00	= [((	7.80E+00	/ 2) x	0.33	) + (	7.80E+00		0.25	)] / (	0.33	+	0.25	)
Dibenzofuran	7.23E+00	= [((	1.01E+01	/ 2) x	0.33	) + (	1.01E+01		0.25	)] / (	0.33	+	0.25	)
Dimethyl phthalate	2.31E+00	= [((	3.23E+00	/ 2) x	0.33	) + (	3.23E+00		0.25	)] / (	0.33	+	0.25	)
Pentachlorophenol	na	= [((	na	/ 2) x	0.33	) + (	na		0.25	)] / (	0.33	+	0.25	)
Naphthalene	7.50E+01	= [((	1.05E+02	/ 2) x	0.33	) + (	1.05E+02		0.25	)] / (	0.33	+	0.25	)
Benz(a)anthracene	na	= [((	na	/ 2) x	0.33	) + (	na		0.25	)] / (	0.33	+	0.25	)
Benzo(a)pyrene	na	= [((	na	/ 2) x	0.33	) + (	na		0.25	)] / (	0.33	+	0.25	)
Benzo(b)fluoranthene	na	= [((	na	/ 2) x	0.33	) + (	na		0.25	)] / (	0.33	+	0.25	)
Chrysene	na	= [((	na	/ 2) x	0.33	) + (	na		0.25	)] / (	0.33	+	0.25	)
Dibenz(a,h)anthracene	na	= [((	na	/ 2) x	0.33	) + (	na		0.25	)] / (	0.33	+	0.25	)
Indeno(1,2,3-cd)pyrene	na	= [((	na	/ 2) x	0.33	) + (	na		0.25	)] / (	0.33	+	0.25	)

CA = chemical concentraiton in air

CA_{max} = maximum chemical concentration in air

t1 = time of shower (20 minutes)

t2 = time in bathroom after shower (15 minutes)

Table B2.8 SMA 4 On-site Groundwater Concentration of chemicals in air (CA-trench) Construction/utility workers working in a trench Groundwater less than 15 feet deep [revised 10/5/07]	CAS No.	Molecular Weight MWi g/mol	Henry's Law Constant Hi atm-m3/mol	Gas-Phase Mass Transfer Coefficient KiG cm/s	Liquid-Phase Mass Transfer Coefficient KiL cm/s	Overall Mass Transfer Coefficient Ki cm/s	Concentration of Contaminant in Groundwater Cgw ug/L	Volatilization Factor VF L/m3	Concentration of Contaminant in Trench Ctrench ug/m3	Concentration of Contaminant in Trench Ctrench mg/m3
Vinyl Chloride	75-01-4	62.50	2.70E-02	5.49E-01	1.43E-03	1.43E-03	7.92E+01	1.05E+01	8.35E+02	8.35E-01
Acetone	67-64-1	58.08	3.88E-05	5.63E-01	1.48E-03	5.58E-04	1.50E+03	4.12E+00	6.17E+03	6.17E+00
Methylene chloride	75-09-2	84.93	2.19E-03	4.95E-01	1.23E-03	1.19E-03	8.75E+01	8.82E+00	7.72E+02	7.72E-01
cis-1,2-Dichloroethene	156-59-2	96.94	4.08E-03	4.74E-01	1.15E-03	1.13E-03	5.46E+01	8.36E+00	4.57E+02	4.57E-01
Benzene	71-43-2	78.11	5.55E-03	5.09E-01	1.28E-03	1.27E-03	1.80E+04	9.35E+00	1.68E+05	1.68E+02
1,2-Dichloroethane	107-06-2	98.96	9.79E-04	4.71E-01	1.14E-03	1.07E-03	7.50E+01	7.92E+00	5.94E+02	5.94E-01
Trichloroethene	79-01-6	131.39	1.03E-02	4.28E-01	9.87E-04	9.82E-04	1.24E+00	7.25E+00	9.00E+00	9.00E-03
Toluene	108-88-3	92.14	6.64E-03	4.82E-01	1.18E-03	1.17E-03	1.43E+04	8.62E+00	1.23E+05	1.23E+02
Chlorobenzene	108-90-7	112.56	3.70E-03	4.51E-01	1.07E-03	1.05E-03	4.44E+04	7.75E+00	3.44E+05	3.44E+02
Ethylbenzene	100-41-4	106.17	7.88E-03	4.60E-01	1.10E-03	1.09E-03	4.40E-01	8.05E+00	3.54E+00	3.54E-03
m-xylene	108-38-3	106.17	7.34E-03	4.60E-01	1.10E-03	1.09E-03	3.49E+01	8.04E+00	2.80E+02	2.80E-01
Isopropylbenzene	98-82-8	120.19	1.16E+00	4.41E-01	1.03E-03	1.03E-03	8.06E+00	7.62E+00	6.14E+01	6.14E-02
1,4-dioxane	123-91-1	88.11	4.80E-06	4.89E-01	1.21E-03	8.90E-05	1.83E+00	6.57E-01	1.20E+00	1.20E-03
Cyclyhexane, methyl	108-87-2	98.19	4.30E-01	4.72E-01	1.14E-03	1.14E-03	1.72E+00	8.43E+00	1.45E+01	1.45E-02
1,2,4-Trichlorobenzene	120-82-1	181.45	1.42E-03	3.84E-01	8.40E-04	8.09E-04	3.27E+01	5.98E+00	1.95E+02	1.95E-01
1,3-Dichlorobenzene (meta)	541-73-1	147.00	3.10E-03	4.12E-01	9.33E-04	9.17E-04	2.11E+00	6.77E+00	1.43E+01	1.43E-02
1,4-Dichlorobenzene (para)	106-46-7	147.00	2.43E-03	4.12E-01	9.33E-04	9.12E-04	2.29E+02	6.74E+00	1.54E+03	1.54E+00
2-Chlorophenol	95-57-8	128.56	3.91E-04	4.31E-01	9.98E-04	8.72E-04	6.23E+00	6.44E+00	4.01E+01	4.01E-02
Acetophenone	98-86-2	120.15	1.07E-05	4.41E-01	1.03E-03	1.63E-04	7.48E-01	1.20E+00	8.98E-01	8.98E-04
Carbazole	86-74-8	167.21	1.54E-08	3.95E-01	8.75E-04	2.49E-07	5.67E-01	1.84E-03	1.04E-03	1.04E-06
Dibenzofuran	132-64-9	168.19	1.26E-05	3.94E-01	8.72E-04	1.65E-04	7.35E-01	1.22E+00	8.94E-01	8.94E-04
Dimethylphthalate	131-11-3	194.18	1.05E-07	3.76E-01	8.12E-04	1.61E-06	2.35E-01	1.19E-02	2.79E-03	2.79E-06
Pentachlorophenol	87-86-5	na	na	na	na	na	na	na	na	na
Naphthalene	91-20-3	128.17	4.83E-04	4.32E-01	9.99E-04	8.95E-04	7.62E+00	6.60E+00	5.03E+01	5.03E-02
Benzo(a)anthracene	56-55-3	na	na	na	na	na	na	na	na	na
Benzo(a)pyrene	50-32-8	na	na	na	na	na	na	na	na	na
Benzo(b)fluoranthene	205-99-2	na	na	na	na	na	na	na	na	na
Chrysene	218-01-9	na	na	na	na	na	na	na	na	na
Dibenzo(a,h)anthracene	53-70-3	na	na	na	na	na	na	na	na	na
Indeno(1,2,3-cd)pyrene	193-39-5	na	na	na	na	na	na	na	na	na

Source of table: Virginia Department of Environmental Quality, Table 3-7: Groundwater: Construction Worker in a Trench.
na = not applicable

Table B2.9
SMA 4 On-site Groundwater - Daily Intake Calculations: Industrial/Commercial Worker
Inhalation of Chemicals in Groundwater While Showering
ERP Coke Facility, Birmingham, AL

Equation	EC	= [	CA	x	ET	x	EF	x	ED	x	CF	] / [	AT	]
Units	µg/m^3		µg/m^3		hours/day		days/year		years		days/hour		days	
CARCINOGENIC EFFECTS														
Vinylchloride	4.64E+00	= [	7.79E+02	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Acetone	8.79E+01	= [	1.47E+04	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Methylene chloride	5.13E+00	= [	8.61E+02	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
cis-1,2-Dichloroethene	3.20E+00	= [	5.37E+02	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Benzene	1.06E+03	= [	1.77E+05	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
1,2-Dichloroethane	4.40E+00	= [	7.38E+02	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Trichloroethene	7.28E-02	= [	1.22E+01	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Toluene	8.36E+02	= [	1.40E+05	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Chlorobenzene	2.60E+03	= [	4.37E+05	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Ethylbenzene	2.58E-02	= [	4.33E+00	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
m,p-Xylenes	2.04E+00	= [	3.43E+02	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Isopropylbenzene	4.73E-01	= [	7.93E+01	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
1,4-Dioxane	1.07E-01	= [	1.80E+01	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Cyclohexane, Methyl-	1.01E-01	= [	1.70E+01	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
1,2,4-Trichlorobenzene	1.91E+00	= [	3.21E+02	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
1,3-Dichlorobenzene	1.24E-01	= [	2.08E+01	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
1,4-Dichlorobenzene	1.34E+01	= [	2.25E+03	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
2-Chlorophenol	3.65E-01	= [	6.13E+01	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Acetophenone	4.39E-02	= [	7.36E+00	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Carbazole	3.32E-02	= [	5.58E+00	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Dibenzofuran	4.31E-02	= [	7.23E+00	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Dimethyl phthalate	1.38E-02	= [	2.31E+00	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Pentachlorophenol	na	= [	na	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Naphthalene	4.47E-01	= [	7.50E+01	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Benz(a)anthracene	na	= [	na	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Benzo(a)pyrene	na	= [	na	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Benzo(b)fluoranthene	na	= [	na	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Chrysene	na	= [	na	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Dibenz(a,h)anthracene	na	= [	na	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]
Indeno(1,2,3-cd)pyrene	na	= [	na	x	0.58	x	250	x	25	x	0.042	] / [	25,550	]

Table B2.9
SMA 4 On-site Groundwater - Daily Intake Calculations: Industrial/Commercial Worker
Inhalation of Chemicals in Groundwater While Showering
ERP Coke Facility, Birmingham, AL

Equation	EC	= [	CA	x	ET	x	EF	x	ED	x	CF	] / [	AT	]
Units	**µg/m^3**		**µg/m^3**		**hours/day**		**days/year**		**years**		**days/hour**		**days**	
NONCARCINOGENIC EFFECTS														
Vinylchloride	1.30E+01	= [	7.79E+02	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Acetone	2.46E+02	= [	1.47E+04	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Methylene chloride	1.44E+01	= [	8.61E+02	x	0.58	x	250	x	25		0.042	] / [	9,125	]
cis-1,2-Dichloroethene	8.97E+00	= [	5.37E+02	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Benzene	2.96E+03	= [	1.77E+05	x	0.58	x	250	x	25		0.042	] / [	9,125	]
1,2-Dichloroethane	1.23E+01	= [	7.38E+02	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Trichloroethene	2.04E-01	= [	1.22E+01	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Toluene	2.34E+03	= [	1.40E+05	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Chlorobenzene	7.29E+03	= [	4.37E+05	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Ethylbenzene	7.22E-02	= [	4.33E+00	x	0.58	x	250	x	25		0.042	] / [	9,125	]
m,p-Xylenes	5.72E+00	= [	3.43E+02	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Isopropylbenzene	1.32E+00	= [	7.93E+01	x	0.58	x	250	x	25		0.042	] / [	9,125	]
1,4-Dioxane	3.01E-01	= [	1.80E+01	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Cyclohexane, Methyl-	2.83E-01	= [	1.70E+01	x	0.58	x	250	x	25		0.042	] / [	9,125	]
1,2,4-Trichlorobenzene	5.36E+00	= [	3.21E+02	x	0.58	x	250	x	25		0.042	] / [	9,125	]
1,3-Dichlorobenzene	3.47E-01	= [	2.08E+01	x	0.58	x	250	x	25		0.042	] / [	9,125	]
1,4-Dichlorobenzene	3.76E+01	= [	2.25E+03	x	0.58	x	250	x	25		0.042	] / [	9,125	]
2-Chlorophenol	1.02E+00	= [	6.13E+01	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Acetophenone	1.23E-01	= [	7.36E+00	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Carbazole	9.31E-02	= [	5.58E+00	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Dibenzofuran	1.21E-01	= [	7.23E+00	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Dimethyl phthalate	3.86E-02	= [	2.31E+00	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Pentachlorophenol	na	= [	na	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Naphthalene	1.25E+00	= [	7.50E+01	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Benz(a)anthracene	na	= [	na	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Benzo(a)pyrene	na	= [	na	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Benzo(b)fluoranthene	na	= [	na	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Chrysene	na	= [	na	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Dibenz(a,h)anthracene	na	= [	na	x	0.58	x	250	x	25		0.042	] / [	9,125	]
Indeno(1,2,3-cd)pyrene	na	= [	na	x	0.58	x	250	x	25		0.042	] / [	9,125	]

EC = exposure concentration
CA = chemical concentration in air
ET = exposure time
EF = exposure frequency
ED = exposure duration
CF = conversion factor (1 day/24 hours)
AT = averaging time

Table B2.10
SMA 4 On-site Groundwater - Daily Intake Calculations: Construction Worker
Inhalation of Chemicals in Groundwater While Trenching
ERP Coke Facility, Birmingham, AL

Equation	EC	=	CA	x	ET	x	EF	x	ED	x	CF	/	AT
Units	**µg/m^3**		**µg/m^3**		**hours/day**		**days/year**		**years**		**days/hour**		**days**
CARCINOGENIC EFFECTS													
Vinylchloride	3.43E-01	=	8.35E+02	x	2	x	125	x	1	x	0.042	/	25,550
Acetone	2.54E+00	=	6.17E+03	x	2	x	125	x	1	x	0.042	/	25,550
Methylene chloride	3.17E-01	=	7.72E+02	x	2	x	125	x	1	x	0.042	/	25,550
cis-1,2-Dichloroethene	1.88E-01	=	4.57E+02	x	2	x	125	x	1	x	0.042	/	25,550
Benzene	6.92E+01	=	1.68E+05	x	2	x	125	x	1	x	0.042	/	25,550
1,2-Dichloroethane	2.44E-01	=	5.94E+02	x	2	x	125	x	1	x	0.042	/	25,550
Trichloroethene	3.70E-03	=	9.00E+00	x	2	x	125	x	1	x	0.042	/	25,550
Toluene	5.05E+01	=	1.23E+05	x	2	x	125	x	1	x	0.042	/	25,550
Chlorobenzene	1.42E+02	=	3.44E+05	x	2	x	125	x	1	x	0.042	/	25,550
Ethylbenzene	1.45E-03	=	3.54E+00	x	2	x	125	x	1	x	0.042	/	25,550
m,p-Xylenes	1.15E-01	=	2.80E+02	x	2	x	125	x	1	x	0.042	/	25,550
Isopropylbenzene	2.52E-02	=	6.14E+01	x	2	x	125	x	1	x	0.042	/	25,550
1,4-Dioxane	4.94E-04	=	1.20E+00	x	2	x	125	x	1	x	0.042	/	25,550
Cyclohexane, Methyl-	5.97E-03	=	1.45E+01	x	2	x	125	x	1	x	0.042	/	25,550
1,2,4-Trichlorobenzene	8.02E-02	=	1.95E+02	x	2	x	125	x	1	x	0.042	/	25,550
1,3-Dichlorobenzene	5.88E-03	=	1.43E+01	x	2	x	125	x	1	x	0.042	/	25,550
1,4-Dichlorobenzene	6.34E-01	=	1.54E+03	x	2	x	125	x	1	x	0.042	/	25,550
2-Chlorophenol	1.65E-02	=	4.01E+01	x	2	x	125	x	1	x	0.042	/	25,550
Acetophenone	3.69E-04	=	8.98E-01	x	2	x	125	x	1	x	0.042	/	25,550
Carbazole	4.28E-07	=	1.04E-03	x	2	x	125	x	1	x	0.042	/	25,550
Dibenzofuran	3.67E-04	=	8.94E-01	x	2	x	125	x	1	x	0.042	/	25,550
Dimethyl phthalate	1.15E-06	=	2.79E-03	x	2	x	125	x	1	x	0.042	/	25,550
Pentachlorophenol	na	=	na	x	2	x	125	x	1	x	0.042	/	25,550
Naphthalene	2.07E-02	=	5.03E+01	x	2	x	125	x	1	x	0.042	/	25,550
Benz(a)anthracene	na	=	na	x	2	x	125	x	1	x	0.042	/	25,550
Benzo(a)pyrene	na	=	na	x	2	x	125	x	1	x	0.042	/	25,550
Benzo(b)fluoranthene	na	=	na	x	2	x	125	x	1	x	0.042	/	25,550
Chrysene	na	=	na	x	2	x	125	x	1	x	0.042	/	25,550
Dibenz(a,h)anthracene	na	=	na	x	2	x	125	x	1	x	0.042	/	25,550
Indeno(1,2,3-cd)pyrene	na	=	na	x	2	x	125	x	1	x	0.042	/	25,550

Table B2.10
SMA 4 On-site Groundwater - Daily Intake Calculations: Construction Worker
Inhalation of Chemicals in Groundwater While Trenching
ERP Coke Facility, Birmingham, AL

Equation	EC	=	CA	x	ET	x	EF	x	ED	x	CF	/	AT
Units	**µg/m^3**		**µg/m^3**		**hours/day**		**days/year**		**years**		**days/hour**		**days**
NONCARCINOGENIC EFFECTS													
Vinylchloride	2.40E+01	=	8.35E+02	x	2	x	125	x	1	x	0.042	/	365
Acetone	1.78E+02	=	6.17E+03	x	2	x	125	x	1	x	0.042	/	365
Methylene chloride	2.22E+01	=	7.72E+02	x	2	x	125	x	1	x	0.042	/	365
cis-1,2-Dichloroethene	1.31E+01	=	4.57E+02	x	2	x	125	x	1	x	0.042	/	365
Benzene	4.84E+03	=	1.68E+05	x	2	x	125	x	1	x	0.042	/	365
1,2-Dichloroethane	1.71E+01	=	5.94E+02	x	2	x	125	x	1	x	0.042	/	365
Trichloroethene	2.59E-01	=	9.00E+00	x	2	x	125	x	1	x	0.042	/	365
Toluene	3.54E+03	=	1.23E+05	x	2	x	125	x	1	x	0.042	/	365
Chlorobenzene	9.91E+03	=	3.44E+05	x	2	x	125	x	1	x	0.042	/	365
Ethylbenzene	1.02E-01	=	3.54E+00	x	2	x	125	x	1	x	0.042	/	365
m,p-Xylenes	8.06E+00	=	2.80E+02	x	2	x	125	x	1	x	0.042	/	365
Isopropylbenzene	1.77E+00	=	6.14E+01	x	2	x	125	x	1	x	0.042	/	365
1,4-Dioxane	3.46E-02	=	1.20E+00	x	2	x	125	x	1	x	0.042	/	365
Cyclohexane, Methyl-	4.18E-01	=	1.45E+01	x	2	x	125	x	1	x	0.042	/	365
1,2,4-Trichlorobenzene	5.61E+00	=	1.95E+02	x	2	x	125	x	1	x	0.042	/	365
1,3-Dichlorobenzene	4.12E-01	=	1.43E+01	x	2	x	125	x	1	x	0.042	/	365
1,4-Dichlorobenzene	4.44E+01	=	1.54E+03	x	2	x	125	x	1	x	0.042	/	365
2-Chlorophenol	1.15E+00	=	4.01E+01	x	2	x	125	x	1	x	0.042	/	365
Acetophenone	2.58E-02	=	8.98E-01	x	2	x	125	x	1	x	0.042	/	365
Carbazole	2.99E-05	=	1.04E-03	x	2	x	125	x	1	x	0.042	/	365
Dibenzofuran	2.57E-02	=	8.94E-01	x	2	x	125	x	1	x	0.042	/	365
Dimethyl phthalate	8.04E-05	=	2.79E-03	x	2	x	125	x	1	x	0.042	/	365
Pentachlorophenol	na	=	na	x	2	x	125	x	1	x	0.042	/	365
Naphthalene	1.45E+00	=	5.03E+01	x	2	x	125	x	1	x	0.042	/	365
Benz(a)anthracene	na	=	na	x	2	x	125	x	1	x	0.042	/	365
Benzo(a)pyrene	na	=	na	x	2	x	125	x	1	x	0.042	/	365
Benzo(b)fluoranthene	na	=	na	x	2	x	125	x	1	x	0.042	/	365
Chrysene	na	=	na	x	2	x	125	x	1	x	0.042	/	365
Dibenz(a,h)anthracene	na	=	na	x	2	x	125	x	1	x	0.042	/	365
Indeno(1,2,3-cd)pyrene	na	=	na	x	2	x	125	x	1	x	0.042	/	365

EC = exposure concentration
CA = chemical concentration in air in the trench
ET = exposure time
EF = exposure frequency
ED = exposure duration
CF = conversion factor (1 day/24 hours)
AT = averaging time
na = not applicable

Table B3.1
Risk Characterization
Industrial/Commercial Workers Exposed to SMA 4, Surface Soil 0 - 1 ft
ERP Coke Facility, Birmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)-1**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Ingestion of Chemicals in Soil										
Carbazole	3.33E-08	x	nd	=	na	9.33E-08	/	nd	=	na
Benz(a)anthracene	1.38E-06	x	7.30E-01	=	**1.01E-06**	3.86E-06	/	nd	=	na
Benzo(a)pyrene	1.55E-06	x	7.30E+00	=	**1.13E-05**	4.34E-06	/	nd	=	na
Benzo(b)fluoranthene	2.59E-06	x	7.30E-01	=	**1.89E-06**	7.26E-06	/	nd	=	na
Chrysene	2.19E-06	x	7.30E-03	=	1.60E-08	6.14E-06	/	nd	=	na
Dibenz(a,h)anthracene	4.49E-07	x	7.30E+00	=	**3.28E-06**	1.26E-06	/	nd	=	na
Indeno(1,2,3-cd)pyrene	1.28E-06	x	7.30E-01	=	9.36E-07	3.59E-06	/	nd	=	na
Arsenic	6.08E-06	x	1.50E+00	=	**9.12E-06**	1.70E-05	/	3.00E-04	=	5.68E-02
Chromium	1.54E-05	x	5.00E-01	=	**7.70E-06**	4.31E-05	/	3.00E-03	=	1.44E-02
			Pathway total =		**3.53E-05**			Pathway total =		7.11E-02
Inhalation of Chemicals in Soil†										
Carbazole	1.57E-09	x	nd	=	na	4.40E-09	/	nd	=	na
Benz(a)anthracene	2.86E-05	x	1.10E-04	=	3.14E-09	8.00E-05	/	nd	=	na
Benzo(a)pyrene	9.00E-06	x	1.10E-03	=	9.90E-09	2.52E-05	/	nd	=	na
Benzo(b)fluoranthene	1.55E-05	x	1.10E-04	=	1.71E-09	4.35E-05	/	nd	=	na
Chrysene	3.41E-05	x	1.10E-05	=	3.75E-10	9.56E-05	/	nd	=	na
Dibenz(a,h)anthracene	1.31E-06	x	1.20E-03	=	1.57E-09	3.66E-06	/	nd	=	na
Indeno(1,2,3-cd)pyrene	3.90E-06	x	1.10E-04	=	4.29E-10	1.09E-05	/	nd	=	na
Arsenic	2.87E-07	x	4.30E-03	=	1.23E-09	8.03E-07	/	1.50E-02	=	5.35E-05
Chromium	7.26E-07	x	8.40E-02	=	6.10E-08	2.03E-06	/	1.00E-01	=	2.03E-05
			Pathway total =		7.93E-08			Pathway total =		7.39E-05
Dermal Contact with Chemicals in Soil										
Carbazole	1.39E-08	x	nd	=	na	3.89E-08	/	nd	=	na
Benz(a)anthracene	7.47E-07	x	7.30E-01	=	5.45E-07	2.09E-06	/	nd	=	na
Benzo(a)pyrene	8.39E-07	x	7.30E+00	=	**6.13E-06**	2.35E-06	/	nd	=	na
Benzo(b)fluoranthene	1.40E-06	x	7.30E-01	=	**1.02E-06**	3.93E-06	/	nd	=	na
Chrysene	1.19E-06	x	7.30E-03	=	8.66E-09	3.32E-06	/	nd	=	na
Dibenz(a,h)anthracene	2.43E-07	x	7.30E+00	=	**1.77E-06**	6.81E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	6.94E-07	x	7.30E-01	=	5.07E-07	1.94E-06	/	nd	=	na
Arsenic	7.60E-07	x	1.50E+00	=	**1.14E-06**	2.13E-06	/	3.00E-04	=	7.09E-03
Chromium	na	x	2.00E+01	=	na	na	/	7.50E-05	=	na
			Pathway total =		**1.11E-05**			Pathway total =		7.09E-03
Chemical Totals										
Carbazole			Sum of all pathways	=	na			Sum of all pathways	=	na
Benz(a)anthracene			Sum of all pathways	=	**1.56E-06**			Sum of all pathways	=	na
Benzo(a)pyrene			Sum of all pathways	=	**1.75E-05**			Sum of all pathways	=	na
Benzo(b)fluoranthene			Sum of all pathways	=	**2.92E-06**			Sum of all pathways	=	na
Chrysene			Sum of all pathways	=	2.50E-08			Sum of all pathways	=	na
Dibenz(a,h)anthracene			Sum of all pathways	=	**5.06E-06**			Sum of all pathways	=	na
Indeno(1,2,3-cd)pyrene			Sum of all pathways	=	**1.44E-06**			Sum of all pathways	=	na
Arsenic			Sum of all pathways	=	**1.03E-05**			Sum of all pathways	=	6.39E-02
Chromium			Sum of all pathways	=	**7.76E-06**			Sum of all pathways	=	1.44E-02
	Total Carcinogenic Risk All Pathways and Chemicals			=	**4.65E-05**	Total Noncarcinogenic Risk All Pathways and Chemicals			=	7.83E-02

DI = Chemical Daily Intake
SF = Cancer Slope Factor
CR = Cancer Risk
RfD = Noncancer Reference Dose
HQ = Hazard Quotient

nd = no data
na = not applicable
Bold results indicates risk exceeding 1E-06 for carcinogens and greater than 0.1 for noncancer hazards.
†For the inhalation pathway, the Inhalation Unit Risk, with units of $(\mu g/m^3)^{-1}$, is used as the toxicity value.

Table B3.2
Risk Characterization
Construction Workers Exposed to SMA 4, Surface Soil 0 - 1 ft
ERP Coke Facility, Birmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)-1**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Ingestion of Chemicals in Soil										
Carbazole	6.34E-10	x	nd	=	na	4.43E-08	/	nd	=	na
Benz(a)anthracene	2.62E-08	x	7.30E-01	=	1.91E-08	1.84E-06	/	nd	=	na
Benzo(a)pyrene	2.95E-08	x	7.30E+00	=	2.15E-07	2.06E-06	/	nd	=	na
Benzo(b)fluoranthene	4.93E-08	x	7.30E-01	=	3.60E-08	3.45E-06	/	nd	=	na
Chrysene	4.16E-08	x	7.30E-03	=	3.04E-10	2.92E-06	/	nd	=	na
Dibenz(a,h)anthracene	8.54E-09	x	7.30E+00	=	6.23E-08	5.98E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	2.44E-08	x	7.30E-01	=	1.78E-08	1.71E-06	/	nd	=	na
Arsenic	1.16E-07	x	1.50E+00	=	1.73E-07	8.09E-06	/	3.00E-04	=	2.70E-02
Chromium	2.93E-07	x	5.00E-01	=	1.46E-07	2.05E-05	/	3.00E-03	=	6.83E-03
			Pathway tota	=	6.70E-07			Pathway total	=	3.38E-02
Inhalation of Chemicals in Soil†										
Carbazole	9.05E-12	x	nd	=	na	6.34E-10	/	nd	=	na
Benz(a)anthracene	1.65E-07	x	1.10E-04	=	1.81E-11	1.15E-05	/	nd	=	na
Benzo(a)pyrene	5.19E-08	x	1.10E-03	=	5.70E-11	3.63E-06	/	nd	=	na
Benzo(b)fluoranthene	8.95E-08	x	1.10E-04	=	9.85E-12	6.27E-06	/	nd	=	na
Chrysene	1.97E-07	x	1.10E-05	=	2.16E-12	1.38E-05	/	nd	=	na
Dibenz(a,h)anthracene	7.54E-09	x	1.20E-03	=	9.04E-12	5.28E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	2.24E-08	x	1.10E-04	=	2.47E-12	1.57E-06	/	nd	=	na
Arsenic	1.65E-09	x	4.30E-03	=	7.10E-12	1.16E-07	/	1.50E-02	=	7.71E-06
Chromium	4.18E-09	x	8.40E-02	=	3.51E-10	2.93E-07	/	1.00E-01	=	2.93E-06
			Pathway tota	=	4.57E-10			Pathway total	=	1.06E-05
Dermal Contact with Chemicals in Soil										
Carbazole	7.99E-11	x	nd	=	na	5.60E-09	/	nd	=	na
Benz(a)anthracene	4.30E-09	x	nd	=	na	3.01E-07	/	nd	=	na
Benzo(a)pyrene	4.83E-09	x	nd	=	na	3.38E-07	/	nd	=	na
Benzo(b)fluoranthene	8.08E-09	x	nd	=	na	5.66E-07	/	nd	=	na
Chrysene	6.83E-09	x	nd	=	na	4.78E-07	/	nd	=	na
Dibenz(a,h)anthracene	1.40E-09	x	nd	=	na	9.80E-08	/	nd	=	na
Indeno(1,2,3-cd)pyrene	4.00E-09	x	nd	=	na	2.80E-07	/	nd	=	na
Arsenic	4.38E-09	x	3.00E-04	=	1.31E-12	3.06E-07	/	3.00E-04	=	1.02E-03
Chromium	na	x	3.00E-03	=	na	na	/	7.50E-05	=	na
			Pathway tota	=	1.31E-12			Pathway total	=	1.02E-03
Chemical Totals										
Carbazole	Sum of all pathways			=	na	Sum of all pathways			=	na
Benz(a)anthracene	Sum of all pathways			=	1.92E-08	Sum of all pathways			=	na
Benzo(a)pyrene	Sum of all pathways			=	2.15E-07	Sum of all pathways			=	na
Benzo(b)fluoranthene	Sum of all pathways			=	3.60E-08	Sum of all pathways			=	na
Chrysene	Sum of all pathways			=	3.06E-10	Sum of all pathways			=	na
Dibenz(a,h)anthracene	Sum of all pathways			=	6.23E-08	Sum of all pathways			=	na
Indeno(1,2,3-cd)pyrene	Sum of all pathways			=	1.78E-08	Sum of all pathways			=	na
Arsenic	Sum of all pathways			=	1.73E-07	Sum of all pathways			=	2.80E-02
Chromium	Sum of all pathways			=	1.47E-07	Sum of all pathways			=	6.83E-03
	Total Carcinogenic Risk					Total Noncarcinogenic Risk				
	All Pathways and Chemicals			=	6.71E-07	All Pathways and Chemicals			=	3.48E-02

DI = Chemical Daily Intake
SF = Cancer Slope Factor
CR = Cancer Risk
RfD = Noncancer Reference Dose
HQ = Hazard Quotient

nd = no data
na = not applicable
†For the inhalation pathway, the Inhalation Unit Risk, with units of $(\mu g/m^3)^{-1}$, is used as the toxicity value.

Table B3.3
SMA 4, Surface Soil 0 - 1 ft, Risk Characterization
Adolescent Trespassers Exposed to Soil
ERP Coke Facility, Birmingham, AL

	Carcinogenic Effects							Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**x**	**ADAF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)-1**		**unitless**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Ingestion of Chemicals in Soil												
Carbazole	1.09E-09	x	nd	x	1	=	na	7.62E-09	/	nd	=	na
Benz(a)anthracene	4.51E-08	x	7.30E-01	x	3	=	9.88E-08	3.16E-07	/	nd	=	na
Benzo(a)pyrene	5.07E-08	x	7.30E+00	x	3	=	**1.11E-06**	3.55E-07	/	nd	=	na
Benzo(b)fluoranthene	8.47E-08	x	7.30E-01	x	3	=	1.86E-07	5.93E-07	/	nd	=	na
Chrysene	7.16E-08	x	7.30E-03	x	3	=	1.57E-09	5.01E-07	/	nd	=	na
Dibenz(a,h)anthracene	1.47E-08	x	7.30E+00	x	3	=	3.21E-07	1.03E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	4.19E-08	x	7.30E-01	x	3	=	9.18E-08	2.93E-07	/	nd	=	na
Naphthalene	4.43E-08	x	nd	x	1	=	na	3.10E-07	/	2.00E-02	=	1.55E-05
Aluminum	2.54E-04	x	nd	x	1	=	na	1.78E-03	/	1.00E+00	=	1.78E-03
Arsenic	1.99E-07	x	1.50E+00	x	1	=	2.98E-07	1.39E-06	/	3.00E-04	=	4.64E-03
Chromium	5.03E-07	x	5.00E-01	x	3	=	7.55E-07	3.52E-06	/	3.00E-03	=	1.17E-03
Cobalt	1.29E-07	x	nd	x	1	=	na	9.02E-07	/	3.00E-04	=	3.01E-03
Manganese	1.43E-05	x	nd	x	1	=	na	9.98E-05	/	1.40E-01	=	7.13E-04
Vanadium	4.49E-07	x	nd	x	1	=	na	3.14E-06	/	5.00E-03	=	6.29E-04
				Pathway total = **2.86E-06**						Pathway total = 1.20E-02		
Inhalation of Chemicals in Soil†												
Carbazole	3.77E-12	x	nd	x	1	=	na	2.64E-11	/	nd	=	na
Benz(a)anthracene	6.86E-08	x	1.10E-04	x	3	=	2.26E-11	4.80E-07	/	nd	=	na
Benzo(a)pyrene	2.16E-08	x	1.10E-03	x	3	=	7.13E-11	1.51E-07	/	nd	=	na
Benzo(b)fluoranthene	3.73E-08	x	1.10E-04	x	3	=	1.23E-11	2.61E-07	/	nd	=	na
Chrysene	8.19E-08	x	1.10E-05	x	3	=	2.70E-12	5.73E-07	/	nd	=	na
Dibenz(a,h)anthracene	3.14E-09	x	1.20E-03	x	3	=	1.13E-11	2.20E-08	/	nd	=	na
Indeno(1,2,3-cd)pyrene	9.35E-09	x	1.10E-04	x	3	=	3.09E-12	6.55E-08	/	nd	=	na
Naphthalene	5.72E-06	x	3.40E-05	x	1	=	1.94E-10	4.00E-05	/	3.00E+00	=	1.33E-05
Aluminum	8.80E-07	x	nd	x	1	=	na	6.16E-06	/	5.00E+00	=	1.23E-06
Arsenic	6.88E-10	x	4.30E-03	x	1	=	2.96E-12	4.82E-09	/	1.50E-02	=	3.21E-07
Chromium	1.74E-09	x	8.40E-02	x	3	=	4.39E-10	1.22E-08	/	1.00E-01	=	1.22E-07
Cobalt	4.46E-10	x	9.00E-03	x	1	=	4.02E-12	3.13E-09	/	6.00E-03	=	5.21E-07
Manganese	4.94E-08	x	nd	x	1	=	na	3.46E-07	/	5.00E-02	=	6.91E-06
Vanadium	1.56E-09	x	nd	x	1	=	na	1.09E-08	/	1.00E-01	=	1.09E-07
				Pathway total = 7.64E-10						Pathway total = 2.26E-05		
Dermal Contact with Chemicals in Soil												
Carbazole	1.22E-09	x	nd	x	1	=	na	8.53E-09	/	nd	=	na
Benz(a)anthracene	6.56E-08	x	7.30E-01	x	3	=	1.44E-07	4.59E-07	/	nd	=	na
Benzo(a)pyrene	7.37E-08	x	7.30E+00	x	3	=	**1.61E-06**	5.16E-07	/	nd	=	na
Benzo(b)fluoranthene	1.23E-07	x	7.30E-01	x	3	=	2.70E-07	8.63E-07	/	nd	=	na
Chrysene	1.04E-07	x	7.30E-03	x	3	=	2.28E-09	7.29E-07	/	nd	=	na
Dibenz(a,h)anthracene	2.14E-08	x	7.30E+00	x	3	=	4.68E-07	1.49E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	6.10E-08	x	7.30E-01	x	3	=	1.34E-07	4.27E-07	/	nd	=	na
Naphthalene	6.44E-08	x	nd	x	1	=	na	4.51E-07	/	2.00E-02	=	2.25E-05
Aluminum	na	x	nd	x	1	=	na	na	/	1.00E+00	=	na
Arsenic	6.67E-08	x	1.50E+00	x	1	=	1.00E-07	4.67E-07	/	3.00E-04	=	1.56E-03
Chromium	na	x	2.00E+01	x	3	=	na	na	/	7.50E-05	=	na
Cobalt	na	x	nd	x	1	=	na	na	/	3.00E-04	=	na
Manganese	na	x	nd	x	1	=	na	na	/	1.40E-01	=	na
Vanadium	na	x	nd	x	1	=	na	na	/	1.30E-04	=	na
				Pathway total = **2.73E-06**						Pathway total = 1.58E-03		

Table B3.3
SMA 4, Surface Soil 0 - 1 ft, Risk Characterization
Adolescent Trespassers Exposed to Soil
ERP Coke Facility, Birmingham, AL

	Carcinogenic Effects							Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**x**	**ADAF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)-1**		**unitless**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Chemical Totals												
Carbazole			Sum of all pathways			=	na	Sum of all pathways			=	na
Benz(a)anthracene			Sum of all pathways			=	2.42E-07	Sum of all pathways			=	na
Benzo(a)pyrene			Sum of all pathways			=	**2.72E-06**	Sum of all pathways			=	na
Benzo(b)fluoranthene			Sum of all pathways			=	4.55E-07	Sum of all pathways			=	na
Chrysene			Sum of all pathways			=	3.85E-09	Sum of all pathways			=	na
Dibenz(a,h)anthracene			Sum of all pathways			=	7.89E-07	Sum of all pathways			=	na
Indeno(1,2,3-cd)pyrene			Sum of all pathways			=	2.25E-07	Sum of all pathways			=	na
Naphthalene			Sum of all pathways			=	1.94E-10	Sum of all pathways			=	5.14E-05
Aluminum			Sum of all pathways			=	na	Sum of all pathways			=	1.78E-03
Arsenic			Sum of all pathways			=	3.98E-07	Sum of all pathways			=	6.19E-03
Chromium			Sum of all pathways			=	7.55E-07	Sum of all pathways			=	1.17E-03
Cobalt			Sum of all pathways			=	4.02E-12	Sum of all pathways			=	3.01E-03
Manganese			Sum of all pathways			=	na	Sum of all pathways			=	7.20E-04
Vanadium			Sum of all pathways			=	na	Sum of all pathways			=	6.29E-04
			Total Carcinogenic Risk All Pathways and Chemicals			=	**5.59E-06**	Total Noncarcinogenic Risk All Pathways and Chemicals			=	1.36E-02

DI = Chemical Daily Intake
SF = Cancer Slope Factor
CR = Cancer Risk
RfD = Noncancer Reference Dose
HQ = Hazard Quotient
ADAF = Age-Dependent Adjustment Factor, for mutagenic chemicals
nd = no data
na = not applicable

Bold results indicates risk exceeding 1E-06 for carcinogens and greater than 0.1 for noncancer hazards.
†For the inhalation pathway, the Inhalation Unit Risk, with units of $(\mu g/m^3)^{-1}$, is used as the toxicity value.

Table B3.4
Risk Characterization
Industrial/Commercial Workers Exposed to SMA 4, Subsurface Soil, 2 - 15 ft
ERP Coke Facility, Birmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)-1**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Ingestion of Chemicals in Soil										
1,1,2-Trichloroethane	4.95E-09	x	5.70E-02	=	2.82E-10	1.39E-08	/	4.00E-03	=	3.47E-06
Benzene	5.34E-07	x	5.50E-02	=	2.94E-08	1.50E-06	/	4.00E-03	=	3.74E-04
Chlorobenzene	1.65E-06	x	nd	=	na	4.63E-06	/	2.00E-02	=	2.32E-04
Ethylbenzene	1.60E-07	x	1.10E-02	=	1.76E-09	4.47E-07	/	1.00E-01	=	4.47E-06
Toluene	1.68E-05	x	nd	=	na	4.70E-05	/	8.00E-02	=	5.87E-04
Vinyl chloride	7.09E-10	x	7.20E-01	=	5.11E-10	1.99E-09	/	3.00E-03	=	6.62E-07
Xylenes	1.21E-06	x	nd	=	na	3.40E-06	/	2.00E-01	=	1.70E-05
Benzo(a)anthracene	3.31E-08	x	7.30E-01	=	2.42E-08	9.28E-08	/	nd	=	na
Benzo(a)pyrene	2.77E-08	x	7.30E+00	=	2.03E-07	7.77E-08	/	nd	=	na
Benzo(b)fluoranthene	3.84E-08	x	7.30E-01	=	2.80E-08	1.07E-07	/	nd	=	na
Benzo(k)fluoranthene	8.94E-09	x	7.30E-02	=	6.53E-10	2.50E-08	/	nd	=	na
Carbazole	1.19E-08	x	nd	=	na	3.34E-08	/	nd	=	na
Chrysene	3.00E-08	x	7.30E-03	=	2.19E-10	8.40E-08	/	nd	=	na
Dibenzo(a,h)anthracene	2.93E-09	x	7.30E+00	=	2.14E-08	8.20E-09	/	nd	=	na
Indeno(1,2,3-cd)pyrene	8.44E-09	x	7.30E-01	=	6.16E-09	2.36E-08	/	nd	=	na
Naphthalene	4.92E-07	x	nd	=	na	1.38E-06	/	2.00E-02	=	6.89E-05
Arsenic	6.04E-08	x	1.50E+00	=	9.05E-08	1.69E-07	/	3.00E-04	=	5.63E-04
Chromium	2.00E-07	x	5.00E-01	=	1.00E-07	5.60E-07	/	3.00E-03	=	1.87E-04
			Pathway total =		5.06E-07			Pathway total =		2.04E-03
Inhalation of Chemicals in Soil†										
1,1,2-Trichloroethane	1.19E-04	x	1.60E-05	=	1.91E-09	3.34E-04	/	2.00E-01	=	1.67E-03
Benzene	2.62E-02	x	7.80E-06	=	2.04E-07	7.34E-02	/	3.00E+01	=	2.45E-03
Chlorobenzene	4.45E-02	x	nd	=	na	1.25E-01	/	5.00E+01	=	2.49E-03
Ethylbenzene	4.89E-03	x	2.50E-06	=	1.22E-08	1.37E-02	/	1.00E+03	=	1.37E-05
Toluene	6.80E-01	x	nd	=	na	1.90E+00	/	5.00E+03	=	3.81E-04
Vinyl chloride	1.29E-04	x	4.40E-06	=	5.67E-10	3.61E-04	/	1.00E+02	=	3.61E-06
Xylenes	3.67E-02	x	nd	=	na	1.03E-01	/	1.00E+02	=	1.03E-03
Benzo(a)anthracene	1.46E-06	x	1.10E-04	=	1.61E-10	4.10E-06	/	nd	=	na
Benzo(a)pyrene	3.42E-07	x	1.10E-03	=	3.77E-10	9.59E-07	/	nd	=	na
Benzo(b)fluoranthene	4.89E-07	x	1.10E-04	=	5.38E-11	1.37E-06	/	nd	=	na
Benzo(k)fluoranthene	1.13E-07	x	1.10E-04	=	1.25E-11	3.17E-07	/	nd	=	na
Carbazole	5.63E-10	x	nd	=	na	1.58E-09	/	nd	=	na
Chrysene	9.96E-07	x	1.10E-05	=	1.10E-11	2.79E-06	/	nd	=	na
Dibenzo(a,h)anthracene	1.81E-08	x	1.20E-03	=	2.17E-11	5.06E-08	/	nd	=	na
Indeno(1,2,3-cd)pyrene	5.43E-08	x	1.10E-04	=	5.97E-12	1.52E-07	/	nd	=	na
Naphthalene	1.85E-03	x	3.40E-05	=	6.28E-08	5.17E-03	/	3.00E+00	=	1.72E-03
Arsenic	2.85E-09	x	4.30E-03	=	1.22E-11	7.97E-09	/	1.50E-02	=	5.31E-07
Chromium	9.43E-09	x	8.40E-02	=	7.92E-10	2.64E-08	/	1.00E-01	=	2.64E-07
			Pathway total =		2.83E-07			Pathway total =		9.76E-03

Table B3.4
Risk Characterization
Industrial/Commercial Workers Exposed to SMA 4, Subsurface Soil, 2 - 15 ft
ERP Coke Facility, Birmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)-1**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Dermal Contact with Chemicals in Soil										
1,1,2-Trichloroethane	na	x	5.70E-02	=	na	na	/	4.00E-03	=	na
Benzene	na	x	5.50E-02	=	na	na	/	4.00E-03	=	na
Chlorobenzene	na	x	nd	=	na	na	/	2.00E-02	=	na
Ethylbenzene	na	x	1.10E-02	=	na	na	/	1.00E-01	=	na
Toluene	na	x	nd	=	na	na	/	8.00E-02	=	na
Vinyl chloride	na	x	7.20E-01	=	na	na	/	3.00E-03	=	na
Xylenes	na	x	nd	=	na	na	/	2.00E-01	=	na
Benzo(a)anthracene	1.79E-08	x	7.30E-01	=	1.31E-08	5.02E-08	/	nd	=	na
Benzo(a)pyrene	1.50E-08	x	7.30E+00	=	1.10E-07	4.20E-08	/	nd	=	na
Benzo(b)fluoranthene	2.08E-08	x	7.30E-01	=	1.52E-08	5.82E-08	/	nd	=	na
Benzo(k)fluoranthene	4.84E-09	x	7.30E-02	=	3.53E-10	1.36E-08	/	nd	=	na
Carbazole	4.97E-09	x	nd	=	na	1.39E-08	/	nd	=	na
Chrysene	1.62E-08	x	7.30E-03	=	1.19E-10	4.55E-08	/	nd	=	na
Dibenzo(a,h)anthracene	1.59E-09	x	7.30E+00	=	1.16E-08	4.44E-09	/	nd	=	na
Indeno(1,2,3-cd)pyrene	4.57E-09	x	7.30E-01	=	3.33E-09	1.28E-08	/	nd	=	na
Naphthalene	2.66E-07	x	nd	=	na	7.46E-07	/	2.00E-02	=	3.73E-05
Arsenic	7.54E-09	x	1.50E+00	=	1.13E-08	2.11E-08	/	3.00E-04	=	7.04E-05
Chromium	na	x	2.00E+01	=	na	na	/	7.50E-05	=	na
			Pathway total =		1.65E-07			Pathway total =		1.08E-04
Chemical Totals										
1,1,2-Trichloroethane	Sum of all pathways			=	2.19E-09	Sum of all pathways			=	1.67E-03
Benzene	Sum of all pathways			=	2.34E-07	Sum of all pathways			=	2.82E-03
Chlorobenzene	Sum of all pathways			=	na	Sum of all pathways			=	2.73E-03
Ethylbenzene	Sum of all pathways			=	1.40E-08	Sum of all pathways			=	1.82E-05
Toluene	Sum of all pathways			=	na	Sum of all pathways			=	9.68E-04
Vinyl chloride	Sum of all pathways			=	1.08E-09	Sum of all pathways			=	4.27E-06
Xylenes	Sum of all pathways			=	na	Sum of all pathways			=	1.05E-03
Benzo(a)anthracene	Sum of all pathways			=	3.75E-08	Sum of all pathways			=	na
Benzo(a)pyrene	Sum of all pathways			=	3.12E-07	Sum of all pathways			=	na
Benzo(b)fluoranthene	Sum of all pathways			=	4.32E-08	Sum of all pathways			=	na
Benzo(k)fluoranthene	Sum of all pathways			=	1.02E-09	Sum of all pathways			=	na
Carbazole	Sum of all pathways			=	na	Sum of all pathways			=	na
Chrysene	Sum of all pathways			=	3.48E-10	Sum of all pathways			=	na
Dibenzo(a,h)anthracene	Sum of all pathways			=	3.30E-08	Sum of all pathways			=	na
Indeno(1,2,3-cd)pyrene	Sum of all pathways			=	9.50E-09	Sum of all pathways			=	na
Naphthalene	Sum of all pathways			=	6.28E-08	Sum of all pathways			=	1.83E-03
Arsenic	Sum of all pathways			=	1.02E-07	Sum of all pathways			=	6.34E-04
Chromium	Sum of all pathways			=	1.01E-07	Sum of all pathways			=	1.87E-04
	Total Carcinogenic Risk					Total Noncarcinogenic Risk				
	All Pathways and Chemicals			=	9.54E-07	All Pathways and Chemicals			=	1.19E-02

DI = Chemical Daily Intake
SF = Cancer Slope Factor
CR = Cancer Risk
RfD = Noncancer Reference Dose
HQ = Hazard Quotient

nd = no data
na = not applicable

†For the inhalation pathway, the Inhalation Unit Risk, with units of $(\mu g/m^3)^{-1}$, is used as the toxicity value.

Table B3.5
Risk Characterization
Construction Workers Exposed to SMA 4, Subsurface Soil, 2 - 15 ft
ERP Coke Facility, Birmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)-1**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Ingestion of Chemicals in Soil										
1,1,2-Trichloroethane	3.27E-08	x	5.70E-02	=	1.86E-09	2.29E-06	/	4.00E-03	=	5.72E-04
Benzene	3.52E-06	x	5.50E-02	=	1.94E-07	2.47E-04	/	4.00E-03	=	6.17E-02
Chlorobenzene	1.09E-05	x	nd	=	na	7.64E-04	/	2.00E-02	=	3.82E-02
Ethylbenzene	1.05E-06	x	1.10E-02	=	1.16E-08	7.38E-05	/	1.00E-01	=	7.38E-04
Toluene	1.11E-04	x	nd	=	na	7.75E-03	/	8.00E-02	=	9.69E-02
Vinyl chloride	4.68E-09	x	7.20E-01	=	3.37E-09	3.28E-07	/	3.00E-03	=	1.09E-04
Xylenes	8.01E-06	x	nd	=	na	5.61E-04	/	2.00E-01	=	2.80E-03
Benzo(a)anthracene	2.19E-07	x	7.30E-01	=	1.60E-07	1.53E-05	/	nd	=	na
Benzo(a)pyrene	1.83E-07	x	7.30E+00	=	**1.34E-06**	1.28E-05	/	nd	=	na
Benzo(b)fluoranthene	2.53E-07	x	7.30E-01	=	1.85E-07	1.77E-05	/	nd	=	na
Benzo(k)fluoranthene	5.90E-08	x	7.30E-02	=	4.31E-09	4.13E-06	/	nd	=	na
Carbazole	7.88E-08	x	nd	=	na	5.52E-06	/	nd	=	na
Chrysene	1.98E-07	x	7.30E-03	=	1.44E-09	1.39E-05	/	nd	=	na
Dibenzo(a,h)anthracene	1.93E-08	x	7.30E+00	=	1.41E-07	1.35E-06	/	nd	=	na
Indeno(1,2,3-cd)pyrene	5.57E-08	x	7.30E-01	=	4.07E-08	3.90E-06	/	nd	=	na
Naphthalene	3.25E-06	x	nd	=	na	2.27E-04	/	2.00E-02	=	1.14E-02
Arsenic	3.98E-07	x	1.50E+00	=	5.97E-07	2.79E-05	/	3.00E-04	=	9.29E-02
Chromium	1.32E-06	x	5.00E-01	=	6.60E-07	9.24E-05	/	3.00E-03	=	3.08E-02
			Pathway total	=	**3.34E-06**			Pathway total	=	**3.36E-01**
Inhalation of Chemicals in Soil†										
1,1,2-Trichloroethane	2.39E-04	x	1.60E-05	=	3.82E-09	1.67E-02	/	2.00E-01	=	8.35E-02
Benzene	5.24E-02	x	7.80E-06	=	4.09E-07	3.67E+00	/	3.00E+01	=	**1.22E-01**
Chlorobenzene	8.91E-02	x	nd	=	na	6.24E+00	/	5.00E+01	=	**1.25E-01**
Ethylbenzene	9.78E-03	x	2.50E-06	=	2.45E-08	6.85E-01	/	1.00E+03	=	6.85E-04
Toluene	1.36E+00	x	nd	=	na	9.52E+01	/	5.00E+03	=	1.90E-02
Vinyl chloride	2.58E-04	x	4.40E-06	=	1.13E-09	1.80E-02	/	1.00E+02	=	1.80E-04
Xylenes	7.35E-02	x	nd	=	na	5.14E+00	/	1.00E+02	=	5.14E-02
Benzo(a)anthracene	2.93E-06	x	1.10E-04	=	3.22E-10	2.05E-04	/	nd	=	na
Benzo(a)pyrene	6.85E-07	x	1.10E-03	=	7.53E-10	4.79E-05	/	nd	=	na
Benzo(b)fluoranthene	9.78E-07	x	1.10E-04	=	1.08E-10	6.85E-05	/	nd	=	na
Benzo(k)fluoranthene	2.27E-07	x	1.10E-04	=	2.49E-11	1.59E-05	/	nd	=	na
Carbazole	1.13E-09	x	nd	=	na	7.88E-08	/	nd	=	na
Chrysene	1.99E-06	x	1.10E-05	=	2.19E-11	1.39E-04	/	nd	=	na
Dibenzo(a,h)anthracene	3.61E-08	x	1.20E-03	=	4.33E-11	2.53E-06	/	nd	=	na
Indeno(1,2,3-cd)pyrene	1.09E-07	x	1.10E-04	=	1.19E-11	7.60E-06	/	nd	=	na
Naphthalene	3.70E-03	x	3.40E-05	=	1.26E-07	2.59E-01	/	3.00E+00	=	8.62E-02
Arsenic	5.69E-09	x	4.30E-03	=	2.45E-11	3.98E-07	/	1.50E-02	=	2.66E-05
Chromium	1.89E-08	x	8.40E-02	=	1.58E-09	1.32E-06	/	1.00E-01	=	1.32E-05
			Pathway total	=	5.67E-07			Pathway total	=	**4.88E-01**

Table B3.5
Risk Characterization
Construction Workers Exposed to SMA 4, Subsurface Soil, 2 - 15 ft
ERP Coke Facility, Birmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)-1**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Dermal Contact with Chemicals in Soil										
1,1,2-Trichloroethane	na	x	5.70E-02	=	na	na	/	4.00E-03	=	na
Benzene	na	x	5.50E-02	=	na	na	/	4.00E-03	=	na
Chlorobenzene	na	x	nd	=	na	na	/	2.00E-02	=	na
Ethylbenzene	na	x	1.10E-02	=	na	na	/	1.00E-01	=	na
Toluene	na	x	nd	=	na	na	/	8.00E-02	=	na
Vinyl chloride	na	x	7.20E-01	=	na	na	/	3.00E-03	=	na
Xylenes	na	x	nd	=	na	na	/	2.00E-01	=	na
Benzo(a)anthracene	3.59E-08	x	7.30E-01	=	2.62E-08	2.51E-06	/	nd	=	na
Benzo(a)pyrene	3.00E-08	x	7.30E+00	=	2.19E-07	2.10E-06	/	nd	=	na
Benzo(b)fluoranthene	4.15E-08	x	7.30E-01	=	3.03E-08	2.91E-06	/	nd	=	na
Benzo(k)fluoranthene	9.68E-09	x	7.30E-02	=	7.07E-10	6.78E-07	/	nd	=	na
Carbazole	9.94E-09	x	nd	=	na	6.96E-07	/	nd	=	na
Chrysene	3.25E-08	x	7.30E-03	=	2.37E-10	2.27E-06	/	nd	=	na
Dibenzo(a,h)anthracene	3.17E-09	x	7.30E+00	=	2.32E-08	2.22E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	9.14E-09	x	7.30E-01	=	6.67E-09	6.40E-07	/	nd	=	na
Naphthalene	5.33E-07	x	nd	=	na	3.73E-05	/	2.00E-02	=	1.86E-03
Arsenic	1.51E-08	x	1.50E+00	=	2.26E-08	1.06E-06	/	3.00E-04	=	3.52E-03
Chromium	na	x	2.00E+01	=	na	na	/	7.50E-05	=	na
			Pathway total	=	3.29E-07			Pathway total	=	5.38E-03
Chemical Totals										
1,1,2-Trichloroethane	Sum of all pathways			=	5.68E-09	Sum of all pathways			=	8.41E-02
Benzene	Sum of all pathways			=	6.03E-07	Sum of all pathways			=	**1.84E-01**
Chlorobenzene	Sum of all pathways			=	na	Sum of all pathways			=	**1.63E-01**
Ethylbenzene	Sum of all pathways			=	3.61E-08	Sum of all pathways			=	1.42E-03
Toluene	Sum of all pathways			=	na	Sum of all pathways			=	**1.16E-01**
Vinyl chloride	Sum of all pathways			=	4.50E-09	Sum of all pathways			=	2.90E-04
Xylenes	Sum of all pathways			=	na	Sum of all pathways			=	5.42E-02
Benzo(a)anthracene	Sum of all pathways			=	1.86E-07	Sum of all pathways			=	na
Benzo(a)pyrene	Sum of all pathways			=	**1.56E-06**	Sum of all pathways			=	na
Benzo(b)fluoranthene	Sum of all pathways			=	2.15E-07	Sum of all pathways			=	na
Benzo(k)fluoranthene	Sum of all pathways			=	5.04E-09	Sum of all pathways			=	na
Carbazole	Sum of all pathways			=	na	Sum of all pathways			=	na
Chrysene	Sum of all pathways			=	1.70E-09	Sum of all pathways			=	na
Dibenzo(a,h)anthracene	Sum of all pathways			=	1.64E-07	Sum of all pathways			=	na
Indeno(1,2,3-cd)pyrene	Sum of all pathways			=	4.73E-08	Sum of all pathways			=	na
Naphthalene	Sum of all pathways			=	1.26E-07	Sum of all pathways			=	9.95E-02
Arsenic	Sum of all pathways			=	6.20E-07	Sum of all pathways			=	9.65E-02
Chromium	Sum of all pathways			=	6.62E-07	Sum of all pathways			=	3.08E-02
	Total Carcinogenic Risk					Total Noncarcinogenic Risk				
	All Pathways and Chemicals			=	**4.23E-06**	All Pathways and Chemicals			=	**8.30E-01**

DI = Chemical Daily Intake
SF = Cancer Slope Factor
CR = Cancer Risk
RfD = Noncancer Reference Dose
HQ = Hazard Quotient

nd = no data
na = not applicable
Bold results indicates risk exceeding 1E-06 for carcinogens and greater than 0.1 for noncancer hazards.
†For the inhalation pathway, the Inhalation Unit Risk, with units of $(\mu g/m^3)^{-1}$, is used as the toxicity value.

Table B3.6
Risk Characterization
Industrial/Commercial Workers Exposed to SMA 4 Mineral Wool Pile
ERP Coke Facility, Birmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)-1**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Ingestion of Chemicals in SWA										
Benzo(a)pyrene	4.58E-09	x	7.30E+00	=	3.34E-08	1.28E-08	/	nd	=	na
Benzo(a)anthracene	4.45E-09	x	7.30E-01	=	3.25E-09	1.25E-08	/	nd	=	na
Benzo(b)fluoranthene	3.58E-09	x	7.30E-01	=	2.61E-09	1.00E-08	/	nd	=	na
Chrysene	3.87E-09	x	7.30E-03	=	2.82E-11	1.08E-08	/	nd	=	na
Dibenz(a,h)anthracene	2.86E-09	x	7.30E+00	=	2.09E-08	8.01E-09	/	nd	=	na
Indeno(1,2,3-cd)pyrene	1.52E-09	x	7.30E-01	=	1.11E-09	4.25E-09	/	nd	=	na
Carbazole	8.37E-10	x	nd	=	na	2.34E-09	/	nd	=	na
Arsenic	1.06E-07	x	1.50E+00	=	1.60E-07	2.98E-07	/	3.00E-04	=	9.94E-04
Chromium	1.52E-06	x	5.00E-01	=	7.61E-07	4.26E-06	/	3.00E-03	=	1.42E-03
			Pathway total =		9.82E-07			Pathway total =		2.41E-03
Inhalation of Chemicals in SWA†										
Benzo(a)pyrene	1.86E-07	x	1.10E-03	=	2.04E-10	5.19E-07	/	nd	=	na
Benzo(a)anthracene	6.42E-07	x	1.10E-04	=	7.06E-11	1.80E-06	/	nd	=	na
Benzo(b)fluoranthene	1.50E-07	x	1.10E-04	=	1.65E-11	4.19E-07	/	nd	=	na
Chrysene	4.20E-07	x	1.10E-05	=	4.62E-12	1.18E-06	/	nd	=	na
Dibenz(a,h)anthracene	5.82E-08	x	1.20E-03	=	6.98E-11	1.63E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	3.22E-08	x	1.10E-04	=	3.54E-12	9.01E-08	/	nd	=	na
Carbazole	2.74E-10	x	nd	=	na	7.67E-10	/	nd	=	na
Arsenic	3.49E-08	x	4.30E-03	=	1.50E-10	9.76E-08	/	1.50E-02	=	6.51E-06
Chromium	4.98E-07	x	8.40E-02	=	4.18E-08	1.39E-06	/	1.00E-01	=	1.39E-05
			Pathway total =		4.24E-08			Pathway total =		2.05E-05
Dermal Contact with Chemicals in SWA										
Benzo(a)pyrene	2.48E-09	x	7.30E+00	=	1.81E-08	6.94E-09	/	nd	=	na
Benzo(a)anthracene	2.41E-09	x	7.30E-01	=	1.76E-09	6.74E-09	/	nd	=	na
Benzo(b)fluoranthene	1.94E-09	x	7.30E-01	=	1.41E-09	5.42E-09	/	nd	=	na
Chrysene	2.09E-09	x	7.30E-03	=	1.53E-11	5.86E-09	/	nd	=	na
Dibenz(a,h)anthracene	1.55E-09	x	7.30E+00	=	1.13E-08	4.34E-09	/	nd	=	na
Indeno(1,2,3-cd)pyrene	8.22E-10	x	7.30E-01	=	6.00E-10	2.30E-09	/	nd	=	na
Carbazole	na	x	nd	=	na	na	/	nd	=	na
Arsenic	1.33E-08	x	1.50E+00	=	1.99E-08	3.72E-08	/	3.00E-04	=	1.24E-04
Chromium	na	x	2.00E+01	=	na	na	/	1.20E-01	=	na
			Pathway total =		5.31E-08			Pathway total =		1.24E-04
Chemical Totals										
Benzo(a)pyrene			Sum of all pathways	=	5.17E-08			Sum of all pathways	=	na
Benzo(a)anthracene			Sum of all pathways	=	5.07E-09			Sum of all pathways	=	na
Benzo(b)fluoranthene			Sum of all pathways	=	4.04E-09			Sum of all pathways	=	na
Chrysene			Sum of all pathways	=	4.81E-11			Sum of all pathways	=	na
Dibenz(a,h)anthracene			Sum of all pathways	=	3.23E-08			Sum of all pathways	=	na
Indeno(1,2,3-cd)pyrene			Sum of all pathways	=	1.71E-09			Sum of all pathways	=	na
Carbazole			Sum of all pathways	=	na			Sum of all pathways	=	na
Arsenic			Sum of all pathways	=	1.80E-07			Sum of all pathways	=	1.12E-03
Chromium			Sum of all pathways	=	8.02E-07			Sum of all pathways	=	1.43E-03
	Total Carcinogenic Risk All Pathways and Chemicals			=	**1.08E-06**	Total Noncarcinogenic Risk All Pathways and Chemicals			=	2.56E-03

SWA = slag waste aggregate
DI = Chemical Daily Intake
SF = Cancer Slope Factor
CR = Cancer Risk
RfD = Noncancer Reference Dose
HQ = Hazard Quotient
nd = no data
na = not applicable

Bold results indicates risk exceeding 1E-06 for carcinogens
†For the inhalation pathway, the Inhalation Unit Risk, with units of $(\mu g/m^3)^{-1}$, is used as the toxicity value.

Table B3.7
Risk Characterization
Adult Residents Exposed to SMA 4 Mineral Wool Pile
ERP Coke Facility, Birmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)-1**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Inhalation of Chemicals in SWA†										
Benzo(a)pyrene	8.10E-07	x	1.10E-03	=	8.91E-10	2.18E-06	/	nd	=	na
Benzo(a)anthracene	2.81E-06	x	1.10E-04	=	3.09E-10	7.55E-06	/	nd	=	na
Benzo(b)fluoranthene	6.53E-07	x	1.10E-04	=	7.19E-11	1.76E-06	/	nd	=	na
Chrysene	1.84E-06	x	1.10E-05	=	2.02E-11	4.94E-06	/	nd	=	na
Dibenz(a,h)anthracene	2.54E-07	x	1.20E-03	=	3.05E-10	6.84E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	1.41E-07	x	1.10E-04	=	1.55E-11	3.79E-07	/	nd	=	na
Carbazole	1.20E-09	x	nd	=	na	3.22E-09	/	nd	=	na
Arsenic	1.52E-07	x	4.30E-03	=	6.55E-10	4.10E-07	/	1.50E-02	=	2.73E-05
Chromium	2.18E-06	x	8.40E-02	=	1.83E-07	5.86E-06	/	1.00E-01	=	5.86E-05
			Pathway total =		1.85E-07			Pathway total =		8.59E-05

SWA = slag waste aggregate
DI = Chemical Daily Intake
SF = Cancer Slope Factor
CR = Cancer Risk
RfD = Noncancer Reference Dose
HQ = Hazard Quotient
nd = no data
na = not applicable

†For the inhalation pathway, the Inhalation Unit Risk, with units of $(\mu g/m^3)^{-1}$, is used as the toxicity value.

Table B3.8
Risk Characterization
Child Residents Exposed to SWA of SMA 4 Mineral Wool Pile
ERP Coke Facility, Birmingham, AL

	Carcinogenic Effects							Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**		**ADAF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)-1**		**unitless**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Inhalation of Chemicals in SWA†												
Benzo(a)pyrene	6.23E-08	x	1.10E-03	x	10	=	6.86E-10	2.18E-06	/	nd	=	na
Benzo(a)pyrene	1.25E-07	x	1.10E-03	x	3	=	4.11E-10	2.18E-06	/	nd	=	na
Benzo(a)anthracene	2.16E-07	x	1.10E-04	x	10	=	2.37E-10	7.55E-06	/	nd	=	na
Benzo(a)anthracene	4.32E-07	x	1.10E-04	x	3	=	1.42E-10	7.55E-06	/	nd	=	na
Benzo(b)fluoranthene	5.02E-08	x	1.10E-04	x	10	=	5.53E-11	1.76E-06	/	nd	=	na
Benzo(b)fluoranthene	1.00E-07	x	1.10E-04	x	3	=	3.32E-11	1.76E-06	/	nd	=	na
Chrysene	1.41E-07	x	1.10E-05	x	10	=	1.55E-11	4.94E-06	/	nd	=	na
Chrysene	2.82E-07	x	1.10E-05	x	3	=	9.32E-12	4.94E-06	/	nd	=	na
Dibenz(a,h)anthracene	1.95E-08	x	1.20E-03	x	10	=	2.35E-10	6.84E-07	/	nd	=	na
Dibenz(a,h)anthracene	3.91E-08	x	1.20E-03	x	3	=	1.41E-10	6.84E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	1.08E-08	x	1.10E-04	x	10	=	1.19E-11	3.79E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	2.16E-08	x	1.10E-04	x	3	=	7.14E-12	3.79E-07	/	nd	=	na
Carbazole	9.21E-11	x	nd	x	1	=	na	3.22E-09	/	nd	=	na
Carbazole	1.84E-10	x	nd	x	1	=	na	3.22E-09	/	nd	=	na
Arsenic	1.17E-08	x	4.30E-03	x	1	=	5.04E-11	4.10E-07	/	1.50E-02	=	2.73E-05
Arsenic	2.34E-08	x	4.30E-03	x	1	=	1.01E-10	4.10E-07	/	1.50E-02	=	2.73E-05
Chromium	1.67E-07	x	8.40E-02	x	10	=	1.41E-07	5.86E-06	/	1.00E-01	=	5.86E-05
Chromium	3.35E-07	x	8.40E-02	x	3	=	8.44E-08	5.86E-06	/	1.00E-01	=	5.86E-05
Chemical Totals			Pathway total =				2.27E-07			Pathway total =		1.72E-04

SWA = slag wool aggregate
DI = Chemical Daily Intake
SF = Cancer Slope Factor
CR = Cancer Risk
RfD = Noncancer Reference Dose
HQ = Hazard Quotient
nd = no data
na = not applicable

†For the inhalation pathway, the Inhalation Unit Risk, with units of $(\mu g/m^3)^{-1}$, is used as the toxicity value.

Table B3.9
SMA 4 On-site Groundwater: Risk Characterization, All COPCs & All Pathways
Industrial/Commercial Workers Exposed to Groundwater
ERP Coke Facility, Birnmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)$^{-1}$**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Ingestion of Chemicals in Groundwater										
Vinylchloride	2.42E-04	x	7.20E-01	=	**1.74E-04**	6.78E-04	/	3.00E-03	=	**2.26E-01**
Acetone	4.58E-03	x	nd	=	na	1.28E-02	/	9.00E-01	=	1.43E-02
Methylene chloride	2.68E-04	x	2.00E-03	=	5.35E-07	7.49E-04	/	6.00E-03	=	**1.25E-01**
cis-1,2-Dichloroethene	1.67E-04	x	nd	=	na	4.68E-04	/	2.00E-03	=	**2.34E-01**
Benzene	5.51E-02	x	5.50E-02	=	**3.03E-03**	1.54E-01	/	4.00E-03	=	**3.85E+01**
1,2-Dichloroethane	2.29E-04	x	9.10E-02	=	**2.09E-05**	6.42E-04	/	6.00E-03	=	**1.07E-01**
Trichloroethene	3.80E-06	x	4.60E-02	=	1.75E-07	1.06E-05	/	5.00E-04	=	2.13E-02
Toluene	4.36E-02	x	nd	=	na	1.22E-01	/	8.00E-02	=	**1.53E+00**
Chlorobenzene	1.36E-01	x	nd	=	na	3.80E-01	/	2.00E-02	=	**1.90E+01**
Ethylbenzene	1.35E-06	x	1.10E-02	=	1.48E-08	3.77E-06	/	1.00E-01	=	3.77E-05
m,p-Xylenes	1.07E-04	x	nd	=	na	2.98E-04	/	2.00E-01	=	1.49E-03
Isopropylbenzene	2.47E-05	x	nd	=	na	6.90E-05	/	nd	=	na
1,4-Dioxane	5.60E-06	x	1.00E-01	=	5.60E-07	1.57E-05	/	3.00E-02	=	5.23E-04
Cyclohexane, Methyl-	5.27E-06	x	nd	=	na	1.48E-05	/	nd	=	na
1,2,4-Trichlorobenzene	9.98E-05	x	2.90E-02	=	**2.90E-06**	2.80E-04	/	1.00E-02	=	2.80E-02
1,3-Dichlorobenzene	6.46E-06	x	nd	=	na	1.81E-05	/	nd	=	na
1,4-Dichlorobenzene	7.01E-04	x	5.40E-03	=	**3.78E-06**	1.96E-03	/	7.00E-02	=	2.80E-02
2-Chlorophenol	1.91E-05	x	nd	=	na	5.34E-05	/	5.00E-03	=	1.07E-02
Acetophenone	2.29E-06	x	nd	=	na	6.40E-06	/	1.00E-01	=	6.40E-05
Carbazole	1.73E-06	x	nd	=	na	4.85E-06	/	nd	=	na
Dibenzofuran	2.25E-06	x	nd	=	na	6.29E-06	/	1.00E-03	=	6.29E-03
Dimethyl phthalate	7.19E-07	x	nd	=	na	2.01E-06	/	nd	=	na
Pentachlorophenol	6.42E-05	x	4.00E-01	=	**2.57E-05**	1.80E-04	/	5.00E-03	=	3.60E-02
Naphthalene	2.33E-05	x	nd	=	na	6.53E-05	/	2.00E-02	=	3.26E-03
Benz(a)anthracene	2.68E-07	x	7.30E-01	=	1.96E-07	7.50E-07	/	nd	=	na
Benzo(a)pyrene	1.43E-07	x	7.30E+00	=	**1.05E-06**	4.02E-07	/	nd	=	na
Benzo(b)fluoranthene	1.90E-07	x	7.30E-01	=	1.39E-07	5.32E-07	/	nd	=	na
Chrysene	4.43E-07	x	7.30E-03	=	3.24E-09	1.24E-06	/	nd	=	na
Dibenz(a,h)anthracene	6.57E-08	x	7.30E+00	=	4.80E-07	1.84E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	1.29E-07	x	7.30E-01	=	9.40E-08	3.60E-07	/	nd	=	na
			Pathway total =		**3.26E-03**			Pathway total =		**5.99E+01**
Inhalation† of Chemicals in Groundwater While Showering										
Vinylchloride	4.64E+00	x	4.40E-06	=	**2.04E-05**	1.30E+01	/	1.00E+02	=	**1.30E-01**
Acetone	8.79E+01	x	nd	=	na	2.46E+02	/	3.10E+04	=	7.94E-03
Methylene chloride	5.13E+00	x	1.00E-08	=	5.13E-08	1.44E+01	/	6.00E+02	=	2.39E-02
cis-1,2-Dichloroethene	3.20E+00	x	nd	=	na	8.97E+00	/	nd	=	na
Benzene	1.06E+03	x	7.80E-06	=	**8.23E-03**	2.96E+03	/	3.00E+01	=	**9.85E+01**
1,2-Dichloroethane	4.40E+00	x	2.60E-05	=	**1.14E-04**	1.23E+01	/	7.00E+00	=	**1.76E+00**
Trichloroethene	7.28E-02	x	4.10E-06	=	2.99E-07	2.04E-01	/	2.00E+00	=	**1.02E-01**
Toluene	8.36E+02	x	nd	=	na	2.34E+03	/	5.00E+03	=	**4.68E-01**
Chlorobenzene	2.60E+03	x	nd	=	na	7.29E+03	/	5.00E+01	=	**1.46E+02**
Ethylbenzene	2.58E-02	x	2.50E-06	=	6.45E-08	7.22E-02	/	1.00E+03	=	7.22E-05
m,p-Xylenes	2.04E+00	x	nd	=	na	5.72E+00	/	1.00E+02	=	5.72E-02
Isopropylbenzene	4.73E-01	x	nd	=	na	1.32E+00	/	nd	=	na
1,4-Dioxane	1.07E-01	x	5.00E-06	=	5.37E-07	3.01E-01	/	3.00E+01	=	1.00E-02
Cyclohexane, Methyl-	1.01E-01	x	nd	=	na	2.83E-01	/	nd	=	na
1,2,4-Trichlorobenzene	1.91E+00	x	nd	=	na	5.36E+00	/	2.00E+00	=	**2.68E+00**

Table B3.9
SMA 4 On-site Groundwater: Risk Characterization, All COPCs & All Pathways
Industrial/Commercial Workers Exposed to Groundwater
ERP Coke Facility, Birnmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)$^{-1}$**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
1,3-Dichlorobenzene	1.24E-01	x	nd	=	na	3.47E-01	/	nd	=	na
1,4-Dichlorobenzene	1.34E+01	x	1.10E-05	=	**1.48E-04**	3.76E+01	/	8.00E+02	=	4.70E-02
2-Chlorophenol	3.65E-01	x	nd	=	na	1.02E+00	/	nd	=	na
Acetophenone	4.39E-02	x	nd	=	na	1.23E-01	/	nd	=	na
Carbazole	3.32E-02	x	nd	=	na	9.31E-02	/	nd	=	na
Dibenzofuran	4.31E-02	x	nd	=	na	1.21E-01	/	nd	=	na
Dimethyl phthalate	1.38E-02	x	nd	=	na	3.86E-02	/	nd	=	na
Pentachlorophenol	na	x	5.10E-06	=	na	na	/	nd	=	na
Naphthalene	4.47E-01	x	3.40E-05	=	**1.52E-05**	1.25E+00	/	3.00E+00	=	**4.17E-01**
Benz(a)anthracene	na	x	1.10E-04	=	na	na	/	nd	=	na
Benzo(a)pyrene	na	x	1.10E-03	=	na	na	/	nd	=	na
Benzo(b)fluoranthene	na	x	1.10E-04	=	na	na	/	nd	=	na
Chrysene	na	x	1.10E-05	=	na	na	/	nd	=	na
Dibenz(a,h)anthracene	na	x	1.20E-03	=	na	na	/	nd	=	na
Indeno(1,2,3-cd)pyrene	na	x	1.10E-04	=	na	na	/	nd	=	na
			Pathway total =		**8.53E-03**			Pathway total =		**2.50E+02**
Dermal Absorption of Chemicals in Groundwater While Showering										
Vinylchloride	2.53E-05	x	7.20E-01	=	**1.82E-05**	7.09E-05	/	3.00E-03	=	2.36E-02
Acetone	2.85E-05	x	nd	=	na	7.97E-05	/	9.00E-01	=	8.85E-05
Methylene chloride	1.37E-05	x	2.00E-03	=	2.73E-08	3.82E-05	/	6.00E-03	=	6.37E-03
cis-1,2-Dichloroethene	2.86E-05	x	nd	=	na	8.01E-05	/	2.00E-03	=	4.01E-02
Benzene	1.13E-02	x	5.50E-02	=	**6.22E-04**	3.17E-02	/	4.00E-03	=	**7.92E+00**
1,2-Dichloroethane	1.52E-05	x	9.10E-02	=	**1.38E-06**	4.26E-05	/	6.00E-03	=	7.09E-03
Trichloroethene	8.57E-07	x	4.60E-02	=	3.94E-08	2.40E-06	/	5.00E-04	=	4.80E-03
Toluene	2.05E-02	x	nd	=	na	5.73E-02	/	8.00E-02	=	**7.16E-01**
Chlorobenzene	6.60E-02	x	nd	=	na	1.85E-01	/	2.00E-02	=	**9.24E+00**
Ethylbenzene	1.10E-06	x	1.10E-02	=	1.21E-08	3.07E-06	/	1.00E-01	=	3.07E-05
m,p-Xylenes	9.37E-05	x	nd	=	na	2.62E-04	/	2.00E-01	=	1.31E-03
Isopropylbenzene	na	x	nd	=	na	na	/	nd	=	na
1,4-Dioxane	2.74E-08	x	1.00E-01	=	2.74E-09	7.66E-08	/	3.00E-02	=	2.55E-06
Cyclohexane, Methyl-	na	x	nd	=	na	na	/	nd	=	na
1,2,4-Trichlorobenzene	1.89E-04	x	2.90E-02	=	**5.48E-06**	5.29E-04	/	1.00E-02	=	5.29E-02
1,3-Dichlorobenzene	na	x	nd	=	na	na	/	nd	=	na
1,4-Dichlorobenzene	6.83E-04	x	5.40E-03	=	**3.69E-06**	1.91E-03	/	7.00E-02	=	2.73E-02
2-Chlorophenol	2.91E-06	x	nd	=	na	8.14E-06	/	5.00E-03	=	1.63E-03
Acetophenone	1.54E-07	x	nd	=	na	4.31E-07	/	1.00E-01	=	4.31E-06
Carbazole	na	x	nd	=	na	na	/	nd	=	na
Dibenzofuran	5.40E-06	x	nd	=	na	1.51E-05	/	1.00E-03	=	1.51E-02
Dimethyl phthalate	na	x	nd	=	na	na	/	nd	=	na
Pentachlorophenol	9.59E-04	x	4.00E-01	=	**3.84E-04**	2.68E-03	/	5.00E-03	=	**5.37E-01**
Naphthalene	2.07E-05	x	nd	=	na	5.79E-05	/	2.00E-02	=	2.90E-03
Benz(a)anthracene	1.43E-05	x	7.30E-01	=	**1.04E-05**	4.00E-05	/	nd	=	na
Benzo(a)pyrene	1.17E-05	x	7.30E+00	=	**8.52E-05**	3.27E-05	/	nd	=	na
Benzo(b)fluoranthene	8.85E-06	x	7.30E-01	=	**6.46E-06**	2.48E-05	/	nd	=	na
Chrysene	2.56E-05	x	7.30E-03	=	1.87E-07	7.17E-05	/	nd	=	na
Dibenz(a,h)anthracene	8.54E-06	x	7.30E+00	=	**6.24E-05**	2.39E-05	/	nd	=	na
Indeno(1,2,3-cd)pyrene	2.16E-05	x	7.30E-01	=	**1.58E-05**	6.05E-05	/	nd	=	na
			Pathway total =		**1.22E-03**			Pathway total =		**1.86E+01**

Table B3.9
SMA 4 On-site Groundwater: Risk Characterization, All COPCs & All Pathways
Industrial/Commercial Workers Exposed to Groundwater
ERP Coke Facility, Birnmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)$^{-1}$**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Chemical Totals										
Vinylchloride	Sum of all pathways			=	**2.13E-04**	Sum of all pathways			=	**3.80E-01**
Acetone	Sum of all pathways			=	na	Sum of all pathways			=	2.23E-02
Methylene chloride	Sum of all pathways			=	6.14E-07	Sum of all pathways			=	**1.55E-01**
cis-1,2-Dichloroethene	Sum of all pathways			=	na	Sum of all pathways			=	**2.74E-01**
Benzene	Sum of all pathways			=	**1.19E-02**	Sum of all pathways			=	**1.45E+02**
1,2-Dichloroethane	Sum of all pathways			=	**1.37E-04**	Sum of all pathways			=	**1.87E+00**
Trichloroethene	Sum of all pathways			=	5.13E-07	Sum of all pathways			=	**1.28E-01**
Toluene	Sum of all pathways			=	na	Sum of all pathways			=	**2.71E+00**
Chlorobenzene	Sum of all pathways			=	na	Sum of all pathways			=	**1.74E+02**
Ethylbenzene	Sum of all pathways			=	9.13E-08	Sum of all pathways			=	1.41E-04
m,p-Xylenes	Sum of all pathways			=	na	Sum of all pathways			=	6.00E-02
Isopropylbenzene	Sum of all pathways			=	na	Sum of all pathways			=	na
1,4-Dioxane	Sum of all pathways			=	**1.10E-06**	Sum of all pathways			=	1.05E-02
Cyclohexane, Methyl-	Sum of all pathways			=	na	Sum of all pathways			=	na
1,2,4-Trichlorobenzene	Sum of all pathways			=	8.38E-06	Sum of all pathways			=	**2.76E+00**
1,3-Dichlorobenzene	Sum of all pathways			=	na	Sum of all pathways			=	na
1,4-Dichlorobenzene	Sum of all pathways			=	**1.55E-04**	Sum of all pathways			=	**1.02E-01**
2-Chlorophenol	Sum of all pathways			=	na	Sum of all pathways			=	1.23E-02
Acetophenone	Sum of all pathways			=	na	Sum of all pathways			=	6.84E-05
Carbazole	Sum of all pathways			=	na	Sum of all pathways			=	na
Dibenzofuran	Sum of all pathways			=	na	Sum of all pathways			=	2.14E-02
Dimethyl phthalate	Sum of all pathways			=	na	Sum of all pathways			=	na
Pentachlorophenol	Sum of all pathways			=	**4.09E-04**	Sum of all pathways			=	**5.73E-01**
Naphthalene	Sum of all pathways			=	**1.52E-05**	Sum of all pathways			=	**4.23E-01**
Benz(a)anthracene	Sum of all pathways			=	**1.06E-05**	Sum of all pathways			=	na
Benzo(a)pyrene	Sum of all pathways			=	**8.62E-05**	Sum of all pathways			=	na
Benzo(b)fluoranthene	Sum of all pathways			=	**6.60E-06**	Sum of all pathways			=	na
Chrysene	Sum of all pathways			=	1.90E-07	Sum of all pathways			=	na
Dibenz(a,h)anthracene	Sum of all pathways			=	**6.28E-05**	Sum of all pathways			=	na
Indeno(1,2,3-cd)pyrene	Sum of all pathways			=	**1.59E-05**	Sum of all pathways			=	na
	Total Carcinogenic Risk All Pathways and Chemicals			=	**1.30E-02**	Total Noncarcinogenic Risk All Pathways and Chemical			=	**3.29E+02**

DI = Chemical Daily Intake
SF = Cancer Slope Factor
CR = Cancer Risk
RfD = Noncancer Reference Dose
HQ = Hazard Quotient
nd = no data
na = not applicable

Bold results indicates risk exceeding 1E-06 for carcinogens and greater than 0.1 for noncancer hazards.

†For the inhalation pathway, the Inhalation Unit Risk, with units of $(\mu g/m^3)^{-1}$, is used as the toxicity value for the carcinogenic evaluation and the Reference Concentration (RfC) with units of $\mu g/m^3$, for the noncarcinogenic evaluation. Intake via inhalation is quantified by EC, the effective concentration, in units of $\mu g/m^3$.

Table B3.10
SMA 4 On-site Groundwater: Risk Characterization, All COPCs & All Pathways
Construction Workers Exposed to Groundwater
ERP Coke Facility, Birnmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)$^{-1}$**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Inhalation† of Chemicals in Groundwater While Trenching										
Vinylchloride	3.43E-01	x	4.40E-06	=	**1.51E-06**	2.40E+01	/	1.00E+02	=	**2.40E-01**
Acetone	2.54E+00	x	nd	=	na	1.78E+02	/	3.10E+04	=	5.73E-03
Methylene chloride	3.17E-01	x	1.00E-08	=	3.17E-09	2.22E+01	/	6.00E+02	=	3.70E-02
cis-1,2-Dichloroethene	1.88E-01	x	nd	=	na	1.31E+01	/	nd	=	na
Benzene	6.92E+01	x	7.80E-06	=	**5.39E-04**	4.84E+03	/	3.00E+01	=	**1.61E+02**
1,2-Dichloroethane	2.44E-01	x	2.60E-05	=	**6.35E-06**	1.71E+01	/	7.00E+00	=	**2.44E+00**
Trichloroethene	3.70E-03	x	4.10E-06	=	1.52E-08	2.59E-01	/	2.00E+00	=	**1.29E-01**
Toluene	5.05E+01	x	nd	=	na	3.54E+03	/	5.00E+03	=	**7.07E-01**
Chlorobenzene	1.42E+02	x	nd	=	na	9.91E+03	/	5.00E+01	=	**1.98E+02**
Ethylbenzene	1.45E-03	x	2.50E-06	=	3.64E-09	1.02E-01	/	1.00E+03	=	1.02E-04
m,p-Xylenes	1.15E-01	x	nd	=	na	8.06E+00	/	1.00E+02	=	8.06E-02
Isopropylbenzene	2.52E-02	x	nd	=	na	1.77E+00	/	nd	=	na
1,4-Dioxane	4.94E-04	x	5.00E-06	=	2.47E-09	3.46E-02	/	3.00E+01	=	1.15E-03
Cyclohexane, Methyl-	5.97E-03	x	nd	=	na	4.18E-01	/	nd	=	na
1,2,4-Trichlorobenzene	8.02E-02	x	nd	=	na	5.61E+00	/	2.00E+00	=	**2.81E+00**
1,3-Dichlorobenzene	5.88E-03	x	nd	=	na	4.12E-01	/	nd	=	na
1,4-Dichlorobenzene	6.34E-01	x	1.10E-05	=	**6.98E-06**	4.44E+01	/	8.00E+02	=	5.55E-02
2-Chlorophenol	1.65E-02	x	nd	=	na	1.15E+00	/	nd	=	na
Acetophenone	3.69E-04	x	nd	=	na	2.58E-02	/	nd	=	na
Carbazole	4.28E-07	x	nd	=	na	2.99E-05	/	nd	=	na
Dibenzofuran	3.67E-04	x	nd	=	na	2.57E-02	/	nd	=	na
Dimethyl phthalate	1.15E-06	x	nd	=	na	8.04E-05	/	nd	=	na
Pentachlorophenol	na	x	5.10E-06	=	na	na	/	nd	=	na
Naphthalene	2.07E-02	x	3.40E-05	=	7.03E-07	1.45E+00	/	3.00E+00	=	**4.83E-01**
Benz(a)anthracene	na	x	1.10E-04	=	na	na	/	nd	=	na
Benzo(a)pyrene	na	x	1.10E-03	=	na	na	/	nd	=	na
Benzo(b)fluoranthene	na	x	1.10E-04	=	na	na	/	nd	=	na
Chrysene	na	x	1.10E-05	=	na	na	/	nd	=	na
Dibenz(a,h)anthracene	na	x	1.20E-03	=	na	na	/	nd	=	na
Indeno(1,2,3-cd)pyrene	na	x	1.10E-04	=	na	na	/	nd	=	na
			Pathway total =		**5.55E-04**			Pathway total =		**3.66E+02**

Table B3.10
SMA 4 On-site Groundwater: Risk Characterization, All COPCs & All Pathways
Construction Workers Exposed to Groundwater
ERP Coke Facility, Birnmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)$^{-1}$**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Dermal Absorption of Chemicals in Groundwater While Trenching										
Vinylchloride	2.82E-07	x	7.20E-01	=	2.03E-07	1.97E-05	/	3.00E-03	=	6.57E-03
Acetone	3.26E-07	x	nd	=	na	2.28E-05	/	9.00E-01	=	2.53E-05
Methylene chloride	1.32E-07	x	2.00E-03	=	2.63E-10	9.21E-06	/	6.00E-03	=	1.53E-03
cis-1,2-Dichloroethene	2.55E-07	x	nd	=	na	1.79E-05	/	2.00E-03	=	8.93E-03
Benzene	1.14E-04	x	5.50E-02	=	**6.26E-06**	7.97E-03	/	4.00E-03	=	**1.99E+00**
1,2-Dichloroethane	1.34E-07	x	9.10E-02	=	1.22E-08	9.36E-06	/	6.00E-03	=	1.56E-03
Trichloroethene	6.11E-09	x	4.60E-02	=	2.81E-10	4.28E-07	/	5.00E-04	=	8.56E-04
Toluene	1.88E-04	x	nd	=	na	1.32E-02	/	8.00E-02	=	**1.65E-01**
Chlorobenzene	5.32E-04	x	nd	=	na	3.72E-02	/	2.00E-02	=	**1.86E+00**
Ethylbenzene	9.20E-09	x	1.10E-02	=	1.01E-10	6.44E-07	/	1.00E-01	=	6.44E-06
m,p-Xylenes	7.87E-07	x	nd	=	na	5.51E-05	/	2.00E-01	=	2.75E-04
Isopropylbenzene	na	x	nd	=	na	na	/	nd	=	na
1,4-Dioxane	2.58E-10	x	1.00E-01	=	2.58E-11	1.81E-08	/	3.00E-02	=	6.02E-07
Cyclohexane, Methyl-	na	x	nd	=	na	na	/	nd	=	na
1,2,4-Trichlorobenzene	9.77E-07	x	2.90E-02	=	2.83E-08	6.84E-05	/	1.00E-02	=	6.84E-03
1,3-Dichlorobenzene	na	x	nd	=	na	na	/	nd	=	na
1,4-Dichlorobenzene	4.41E-06	x	5.40E-03	=	2.38E-08	3.08E-04	/	7.00E-02	=	4.41E-03
2-Chlorophenol	2.11E-08	x	nd	=	na	1.48E-06	/	5.00E-03	=	2.96E-04
Acetophenone	1.18E-09	x	nd	=	na	8.27E-08	/	1.00E-01	=	8.27E-07
Carbazole	na	x	nd	=	na	na	/	nd	=	na
Dibenzofuran	3.04E-08	x	nd	=	na	2.13E-06	/	1.00E-03	=	2.13E-03
Dimethyl phthalate	na	x	nd	=	na	na	/	nd	=	na
Pentachlorophenol	1.13E-06	x	4.00E-01	=	4.53E-07	7.92E-05	/	5.00E-03	=	1.58E-02
Naphthalene	1.51E-07	x	nd	=	na	1.06E-05	/	2.00E-02	=	5.28E-04
Benz(a)anthracene	2.05E-08	x	7.30E-01	=	1.50E-08	1.44E-06	/	nd	=	na
Benzo(a)pyrene	1.42E-08	x	7.30E+00	=	1.04E-07	9.93E-07	/	nd	=	na
Benzo(b)fluoranthene	1.10E-08	x	7.30E-01	=	8.02E-09	7.69E-07	/	nd	=	na
Chrysene	3.67E-08	x	7.30E-03	=	2.68E-10	2.57E-06	/	nd	=	na
Dibenz(a,h)anthracene	8.70E-09	x	7.30E+00	=	6.35E-08	6.09E-07	/	nd	=	na
Indeno(1,2,3-cd)pyrene	2.22E-08	x	7.30E-01	=	1.62E-08	1.55E-06	/	nd	=	na
			Pathway total =		7.19E-06			Pathway total =		**4.07E+00**

Table B3.10
SMA 4 On-site Groundwater: Risk Characterization, All COPCs & All Pathways
Construction Workers Exposed to Groundwater
ERP Coke Facility, Birnmingham, AL

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**(mg/kg-day)$^{-1}$**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Chemical Totals										
Vinylchloride	Sum of all pathways			=	**1.71E-06**	Sum of all pathways			=	**2.47E-01**
Acetone	Sum of all pathways			=	na	Sum of all pathways			=	5.75E-03
Methylene chloride	Sum of all pathways			=	3.44E-09	Sum of all pathways			=	3.85E-02
cis-1,2-Dichloroethene	Sum of all pathways			=	na	Sum of all pathways			=	8.93E-03
Benzene	Sum of all pathways			=	**5.46E-04**	Sum of all pathways			=	**1.63E+02**
1,2-Dichloroethane	Sum of all pathways			=	**6.36E-06**	Sum of all pathways			=	**2.44E+00**
Trichloroethene	Sum of all pathways			=	1.54E-08	Sum of all pathways			=	**1.30E-01**
Toluene	Sum of all pathways			=	na	Sum of all pathways			=	**8.72E-01**
Chlorobenzene	Sum of all pathways			=	na	Sum of all pathways			=	**2.00E+02**
Ethylbenzene	Sum of all pathways			=	3.74E-09	Sum of all pathways			=	1.08E-04
m,p-Xylenes	Sum of all pathways			=	na	Sum of all pathways			=	8.09E-02
Isopropylbenzene	Sum of all pathways			=	na	Sum of all pathways			=	na
1,4-Dioxane	Sum of all pathways			=	2.50E-09	Sum of all pathways			=	1.15E-03
Cyclohexane, Methyl-	Sum of all pathways			=	na	Sum of all pathways			=	na
1,2,4-Trichlorobenzene	Sum of all pathways			=	2.83E-08	Sum of all pathways			=	**2.81E+00**
1,3-Dichlorobenzene	Sum of all pathways			=	na	Sum of all pathways			=	na
1,4-Dichlorobenzene	Sum of all pathways			=	**7.00E-06**	Sum of all pathways			=	5.99E-02
2-Chlorophenol	Sum of all pathways			=	na	Sum of all pathways			=	2.96E-04
Acetophenone	Sum of all pathways			=	na	Sum of all pathways			=	8.27E-07
Carbazole	Sum of all pathways			=	na	Sum of all pathways			=	na
Dibenzofuran	Sum of all pathways			=	na	Sum of all pathways			=	2.13E-03
Dimethyl phthalate	Sum of all pathways			=	na	Sum of all pathways			=	na
Pentachlorophenol	Sum of all pathways			=	4.53E-07	Sum of all pathways			=	1.58E-02
Naphthalene	Sum of all pathways			=	7.03E-07	Sum of all pathways			=	**4.83E-01**
Benz(a)anthracene	Sum of all pathways			=	1.50E-08	Sum of all pathways			=	na
Benzo(a)pyrene	Sum of all pathways			=	1.04E-07	Sum of all pathways			=	na
Benzo(b)fluoranthene	Sum of all pathways			=	8.02E-09	Sum of all pathways			=	na
Chrysene	Sum of all pathways			=	2.68E-10	Sum of all pathways			=	na
Dibenz(a,h)anthracene	Sum of all pathways			=	6.35E-08	Sum of all pathways			=	na
Indeno(1,2,3-cd)pyrene	Sum of all pathways			=	1.62E-08	Sum of all pathways			=	na
	Total Carcinogenic Risk All Pathways and Chemicals			=	**5.62E-04**	Total Noncarcinogenic Risk All Pathways and Chemicals			=	**3.71E+02**

DI = Chemical Daily Intake
SF = Cancer Slope Factor
CR = Cancer Risk
RfD = Noncancer Reference Dose
HQ = Hazard Quotient
nd = no data
na = not applicable

Bold results indicates risk exceeding 1E-06 for carcinogens and greater than 0.1 for noncancer hazards.

†For the inhalation pathway, the Inhalation Unit Risk, with units of $(\mu g/m^3)^{-1}$, is used as the toxicity value for the carcinogenic evaluation and the Reference Concentration (RfC) with units of $\mu g/m^3$, for the noncarcinogenic evaluation. Intake via inhalation is quantified by EC, the effective concentration, in units of $\mu g/m^3$.

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.45, November 2015 RSLs
Table B3.11 - SMA 4, On-site Groundwater, Risk Characterization for Industrial/Commercial Workers

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^oC)	Tgw	25	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
71-43-2	Benzene	1.8E+04	4.09E+03	**2.6E-03**	**3.1E+01**	7.80E-06	I	3.00E-02	I	
108-90-7	Chlorobenzene	4.4E+05	5.65E+04	No IUR	**2.6E+02**			5.00E-02	P	
106-46-7	Dichlorobenzene, 1,4-	2.3E+02	2.26E+01	**2.0E-05**	6.4E-03	1.10E-05	CA	8.00E-01	I	
107-06-2	Dichloroethane, 1,2-	7.5E+01	3.62E+00	**7.7E-06**	1.2E-01	2.60E-05	I	7.00E-03	P	
91-20-3	Naphthalene	7.6E+00	1.37E-01	3.8E-07	1.0E-02	3.40E-05	CA	3.00E-03	I	
108-88-3	Toluene	1.4E+04	3.87E+03	No IUR	1.8E-01			5.00E+00	I	
120-82-1	Trichlorobenzene, 1,2,4-	3.3E+01	1.90E+00	No IUR	2.2E-01			2.00E-03	P	
79-01-6	Trichloroethylene	1.2E+00	5.00E-01	1.7E-07	5.7E-02	see note	I	2.00E-03	I	TCE
75-01-4	Vinyl Chloride	7.9E+01	9.00E+01	**3.2E-05**	2.1E-01	4.40E-06	I	1.00E-01	I	VC
108-38-3	Xylene, m-	3.5E+01	1.02E+01	No IUR	2.3E-02			1.00E-01	S	

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	25
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	25
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	250
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	8

(2) **Generic Attenuation Factors:**

Source Medium of Vapors		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	(-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
	m	IURTCE_R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	0.00E+00
		IURTCE_R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	4.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 25 This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.45, November 2015 RSLs
Table B3.11 - SMA 4, On-site Groundwater, Risk Characterization for Industrial/Commercial Workers

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	25	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR (ug/m^3)$^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

Table B4.1
Preliminary Cleanup Standards (PCSs)
Contribution from Ingestion of Chemicals in Surface Soil, 0 - 1 ft
Industrial/Commercial Worker
ERP Coke Facility, Birmingham, AL

Carcinogenic Effects

Equation	Ing_C	= (	TR	x	AT	x	BW	) / (	EF	x	ED	x	CSF	x	IR	x	CF	)
Units	**mg/Kg**		**unitless**		**years**		**Kg**		**days/yr**		**years**		**(mg/Kg-day)$^{-1}$**		**mg/day**		**Kg/mg**	
Benz(a)anthracene	4.48E+00	= (	1.E-06	x	25550	x	80	) / (	250	x	25	x	7.30E-01	x	100	x	1.00E-06	)
Benzo(a)pyrene	4.48E-01	= (	1.E-06	x	25550	x	80	) / (	250	x	25	x	7.30E+00	x	100	x	1.00E-06	)
Benzo(b)fluoranthene	4.48E+00	= (	1.E-06	x	25550	x	80	) / (	250	x	25	x	7.30E-01	x	100	x	1.00E-06	)
Dibenz(a,h)anthracene	4.48E-01	= (	1.E-06	x	25550	x	80	) / (	250	x	25	x	7.30E+00	x	100	x	1.00E-06	)
Indeno(1,2,3-cd)pyrene	4.48E+00	= (	1.E-06	x	25550	x	80	) / (	250	x	25	x	7.30E-01	x	100	x	1.00E-06	)
Arsenic	2.18E+00	= (	1.E-06	x	25550	x	80	) / (	250	x	25	x	1.50E+00	x	100	x	1.00E-06	)
Chromium	6.54E+00	= (	1.E-06	x	25550	x	80	) / (	250	x	25	x	5.00E-01	x	100	x	1.00E-06	)

Noncarcinogenic Effects

Equation	Ing_{NC}	= (	THQ	x	AT	x	BW	) / (	EF	x	ED	x	(	1	/	RfD	)	x	IR	x	CF	)
Units	**mg/Kg**		**unitless**		**years**		**Kg**		**days/yr**		**years**					**mg/Kg-day**			**mg/day**		**Kg/mg**	
Benz(a)anthracene	na	= (	1.0	x	9125	x	80	) / (	250	x	25	x	(	1	/	nd	)	x	100	x	1.00E-06	)
Benzo(a)pyrene	na	= (	1.0	x	9125	x	80	) / (	250	x	25	x	(	1	/	nd	)	x	100	x	1.00E-06	)
Benzo(b)fluoranthene	na	= (	1.0	x	9125	x	80	) / (	250	x	25	x	(	1	/	nd	)	x	100	x	1.00E-06	)
Dibenz(a,h)anthracene	na	= (	1.0	x	9125	x	80	) / (	250	x	25	x	(	1	/	nd	)	x	100	x	1.00E-06	)
Indeno(1,2,3-cd)pyrene	na	= (	1.0	x	9125	x	80	) / (	250	x	25	x	(	1	/	nd	)	x	100	x	1.00E-06	)
Arsenic	3.89E+09	= (	1.0	x	9125	x	80	) / (	250	x	25	x	(	1	/	3.00E-04	)	x	100	x	1.00E-06	)
Chromium	3.89E+08	= (	1.0	x	9125	x	80	) / (	250	x	25	x	(	1	/	3.00E-03	)	x	100	x	1.00E-06	)

IngC = Carcinogenic contribution from ingestion of chemicals in soil
TR = Target Risk
THQ = Target Hazard Quotient
AT = Averaging time
BW = Body weight
EF = Exposure frequency
ED = Exposure duration
SF = Cancer Slope factor, ora
IR = Soil intake rate
CF = Conversion factor
RfD = Noncancer Reference dose, oral
nd = no data
na = not applicable

Table B4.2
Preliminary Cleanup Standards (PCSs)
Contribution from Dermal Contact with Chemicals in Surface Soil, 0 - 1 ft
Industrial/Commercial Worker
ERP Coke Facility, Birmingham, AL

Carcinogenic Effects

Equation	$Derm_C$	= (	TR	x	AT	x	BW	) / (	EF	x	ED	x	CSF	x	AF	x	SSA	x	EV	x	ABSd	x	CF
Units	**mg/kg**		**unitless**		**days**		**Kg**		**days/year**		**years**		**$(mg/Kg\text{-}day)^{-1}$**		**mg/cm^2-event**		**cm^2**		**events/day**		**unitless**		**Kg/mg**
Benz(a)anthracene	8.28E+00	= (	1.00E-06	x	25550	x	80	) / (	250	x	25	x	7.30E-01	x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Benzo(a)pyrene	8.28E-01	= (	1.00E-06	x	25550	x	80	) / (	250	x	25	x	7.30E+00	x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Benzo(b)fluoranthene	8.28E+00	= (	1.00E-06	x	25550	x	80	) / (	250	x	25	x	7.30E-01	x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Dibenz(a,h)anthracene	8.28E-01	= (	1.00E-06	x	25550	x	80	) / (	250	x	25	x	7.30E+00	x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Indeno(1,2,3-cd)pyrene	8.28E+00	= (	1.00E-06	x	25550	x	80	) / (	250	x	25	x	7.30E-01	x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Arsenic	1.75E+01	= (	1.00E-06	x	25550	x	80	) / (	250	x	25	x	1.50E+00	x	0.12	x	3470	x	1	x	0.03	x	1.00E-06
Chromium	na	= (	1.00E-06	x	25550	x	80	) / (	250	x	25	x	2.00E+01	x	0.12	x	3470	x	1	x	nd	x	1.00E-06

Noncarcinogenic Effects

Equation	$Derm_{NC}$	= (	THQ	x	AT	x	BW	) / (	EF	x	ED	x	(1 /	RfD	x	AF	x	SSA	x	EV	x	ABSd	x	CF
Units	**mg/kg**		**unitless**		**days**		**Kg**		**days/year**		**years**			**$(mg/Kg\text{-}day)^{-1}$**		**mg/cm^2-event**		**cm^2**		**events/day**		**unitless**		**Kg/mg**
Benz(a)anthracene	nd	= (	1	x	9125	x	80	) / (	250	x	25	x	(1 /	nd	x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Benzo(a)pyrene	nd	= (	1	x	9125	x	80	) / (	250	x	25	x	(1 /	nd	x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Benzo(b)fluoranthene	nd	= (	1	x	9125	x	80	) / (	250	x	25	x	(1 /	nd	x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Dibenz(a,h)anthracene	nd	= (	1	x	9125	x	80	) / (	250	x	25	x	(1 /	nd	x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Indeno(1,2,3-cd)pyrene	nd	= (	1	x	9125	x	80	) / (	250	x	25	x	(1 /	nd	x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Arsenic	2.80E+03	= (	1	x	9125	x	80	) / (	250	x	25	x	(1 /	3.00E-04	x	0.12	x	3470	x	1	x	0.03	x	1.00E-06
Chromium	na	= (	1	x	9125	x	80	) / (	250	x	25	x	(1 /	7.50E-05	x	0.12	x	3470	x	1	x	nd	x	1.00E-06

$Derm_C$ = Carcinogenic contribution from inhalation of chemicals in soil
TR = Target Risk
AT = Averaging time
BW = Body weight
EF = Exposure frequency
ED = Exposure duration
CSF = Cancer Slope Factor, dermal
AF = Skin/Soil Adherence Factor
SSA = Skin Surface Area
EV = Event frequency
ABS = Dermal Absorption Factor
$Derm_{NC}$ = Noncarcinogenic contribution from inhalation of chemicals in soil
THQ = Target Hazard Quotient
RfD = Noncancer Reference Dose, inhalation
ADAF = Age-Dependent Adjustment Factor (for mutagens)

Table B4.3
Preliminary Cleanup Standards (PCSs)
Contribution from Inhalation of Chemicals in Surface Soil, 0 - 1 ft
Industrial/Commercial Worker
ERP Coke Facility, Birmingham, AL

																								Carcinogenic Effects										
Equation	**Inh_C**	**=**	**(**	**TR**	**x**	**AT**	**)**	**/**	**(**	**EF**	**x**	**ED**	**x**	**ET**	**x**	**CF_1**	**x**	**IUR**	**x**	**CF_2**	**x**	**[**	**(**	**1**	**/**	**VF**	**)**	**+**	**(**	**1**	**/**	**PEF**	**)**	**]**
Units	**mg/Kg**			**unitless**		**days**				**days/year**		**years**		**hours/day**		**days/hour**		**$(\mu g/m^3)^{-1}$**		**µg/mg**						**m^3/Kg**						**m^3/Kg**		
Benz(a)anthracene	1.44E+03	=	(	1.00E-06	x	25550	)	/	(	250	x	25	x	8	x	0.042	x	1.10E-04	x	1000	x	[	(	1	/	1.30E+07	)	+	(	1	/	5.70E+09	)	]
Benzo(a)pyrene	5.12E+02	=	(	1.00E-06	x	25550	)	/	(	250	x	25	x	8	x	0.042	x	1.10E-03	x	1000	x	[	(	1	/	4.67E+07	)	+	(	1	/	5.70E+09	)	]
Benzo(b)fluoranthene	4.96E+03	=	(	1.00E-06	x	25550	)	/	(	250	x	25	x	8	x	0.042	x	1.10E-04	x	1000	x	[	(	1	/	4.52E+07	)	+	(	1	/	5.70E+09	)	]
Dibenz(a,h)anthracene	9.36E+02	=	(	1.00E-06	x	25550	)	/	(	250	x	25	x	8	x	0.042	x	1.20E-03	x	1000	x	[	(	1	/	9.38E+07	)	+	(	1	/	5.70E+09	)	]
Indeno(1,2,3-cd)pyrene	9.79E+03	=	(	1.00E-06	x	25550	)	/	(	250	x	25	x	8	x	0.042	x	1.10E-04	x	1000	x	[	(	1	/	8.99E+07	)	+	(	1	/	5.70E+09	)	]
Arsenic	1.61E+04	=	(	1.00E-06	x	25550	)	/	(	250	x	25	x	8	x	0.042	x	4.30E-03	x	1000	x	[	(	1	/	na	)	+	(	1	/	5.70E+09	)	]
Chromium	8.26E+02	=	(	1.00E-06	x	25550	)	/	(	250	x	25	x	8	x	0.042	x	8.40E-02	x	1000	x	[	(	1	/	na	)	+	(	1	/	5.70E+09	)	]

Table B4.3 (cont.)
Preliminary Cleanup Standards (PCSs)
Contribution from Inhalation of Chemicals in Surface Soil, 0 - 1 ft
Industrial/Commercial Worker
ERP Coke Facility, Birmingham, AL

Noncarcinogenic Effects

Equation	**Inh_{NC}**	**= (**	**THQ**	**x**	**AT**	**) / (**	**EF**	**x**	**ED**	**x**	**ET**	**x**	**CF**	**x (1 /**	**RfC**	**) x [(1 /**	**VF**	**) + (1 /**	**PEF**	**)]**
Units	**mg/Kg**		**unitless**		**days**		**days/year**		**years**		**hours/day**		**days/hour**		**mg/m^3**		**m^3/Kg**		**m^3/Kg**	
Benz(a)anthracene	na	= (	1.0	x	9125	) / (	250	x	25	x	8	x	0.042	x (1 /	nd	) x [(1 /	1.30E+07	) + (1 /	5.70E+09	)]
Benzo(a)pyrene	na	= (	1.0	x	9125	) / (	250	x	25	x	8	x	0.042	x (1 /	nd	) x [(1 /	4.67E+07	) + (1 /	5.70E+09	)]
Benzo(b)fluoranthene	na	= (	1.0	x	9125	) / (	250	x	25	x	8	x	0.042	x (1 /	nd	) x [(1 /	4.52E+07	) + (1 /	5.70E+09	)]
Dibenz(a,h)anthracene	na	= (	1.0	x	9125	) / (	250	x	25	x	8	x	0.042	x (1 /	nd	) x [(1 /	9.38E+07	) + (1 /	5.70E+09	)]
Indeno(1,2,3-cd)pyrene	na	= (	1.0	x	9125	) / (	250	x	25	x	8	x	0.042	x (1 /	nd	) x [(1 /	8.99E+07	) + (1 /	5.70E+09	)]
Arsenic	3.72E+05	= (	1.0	x	9125	) / (	250	x	25	x	8	x	0.042	x (1 /	1.50E-05	) x [(1 /	na	) + (1 /	5.70E+09	)]
Chromium	2.48E+06	= (	1.0	x	9125	) / (	250	x	25	x	8	x	0.042	x (1 /	1.00E-04	) x [(1 /	na	) + (1 /	5.70E+09	)]

Inh_C = Carcinogenic contribution from the inhalation of chemicals in soil
TR = Target Risk
AT = Averaging time
EF = Exposure frequency
ED = Exposure duration
ET = Exposure time
CF_1 = Conversion factor, day/hours
UR = Inhalation Unit Risk
CF_2 = Conversion factor, g/mg
CSF = Cancer Slope Factor, inhalation
VF = Volatilization factor
PEF = Particulate emission factor
Inh_{NC} = Noncarcinogenic contribution from the dermal absorption of chemicals in soil
THQ = Target Hazard Quotient
RfC = Noncancer Reference concentration, inhalation

Table B4.4
Carcinogenic Preliminary Cleanup Standards (PCSs) for SMA 4, Surface Soil, 0 - 1 ft
Industrial Commercial Worker
ERP Coke Facility, Birmingham, AL

Equation	**PSC**	**= 1 / [(1 /**	**Ing_C**	**) + (1 /**	**$Derm_C$**	**) + (1 /**	**Inh_C**	**)]**
Units	**mg/kg**							
Industrial Worker								
Benz(a)anthracene	2.90E+00	= 1 / [(1 /	4.48E+00	) + (1 /	8.28E+00	) + (1 /	1.44E+03	)]
Benzo(a)pyrene	2.90E-01	= 1 / [(1 /	4.48E-01	) + (1 /	8.28E-01	) + (1 /	5.12E+02	)]
Benzo(b)fluoranthene	2.90E+00	= 1 / [(1 /	4.48E+00	) + (1 /	8.28E+00	) + (1 /	4.96E+03	)]
Dibenz(a,h)anthracene	2.91E-01	= 1 / [(1 /	4.48E-01	) + (1 /	8.28E-01	) + (1 /	9.36E+02	)]
Indeno(1,2,3-cd)pyrene	2.91E+00	= 1 / [(1 /	4.48E+00	) + (1 /	8.28E+00	) + (1 /	9.79E+03	)]
Arsenic	1.94E+00	= 1 / [(1 /	2.18E+00	) + (1 /	1.75E+01	) + (1 /	1.61E+04	)]
Chromium	6.49E+00	= 1 / [(1 /	6.54E+00	) + (1 /	na	) + (1 /	8.26E+02	)]

PSC = Preliminary Cleanup Standards

Ing_C = Noncancer contribution from ingestion of chemicals in soil

$Derm_C$ = Noncancer contribution from dermal contact with chemicals in soil

Inh_C = Noncancer contribution from inhalation of chemicals in soil

Table B4.5
Noncarcinogenic Preliminary Cleanup Standards (PCSs) for SMA 4, Surface Soil, 0 - 1 ft
Industrial Commercial Worker
ERP Coke Facility, Birmingham, AL

Equation	**PSC**	**= 1 / [(1 /**	**Ing_{NC}**	**) + (1 /**	**$Derm_{NC}$**	**) + (1 /**	**Inh_{NC}**	**)]**
Units	**mg/kg**							
Industrial Worker								
Benz(a)anthracene	na	= 1 / [(1 /	na	) + (1 /	nd	) + (1 /	na	)]
Benzo(a)pyrene	na	= 1 / [(1 /	na	) + (1 /	nd	) + (1 /	na	)]
Benzo(b)fluoranthene	na	= 1 / [(1 /	na	) + (1 /	nd	) + (1 /	na	)]
Dibenz(a,h)anthracene	na	= 1 / [(1 /	na	) + (1 /	nd	) + (1 /	na	)]
Indeno(1,2,3-cd)pyrene	na	= 1 / [(1 /	na	) + (1 /	nd	) + (1 /	na	)]
Arsenic	2.78E+03	= 1 / [(1 /	3.89E+09	) + (1 /	2.80E+03	) + (1 /	3.72E+05	)]
Chromium	2.46E+06	= 1 / [(1 /	3.89E+08	) + (1 /	na	) + (1 /	2.48E+06	)]

PSC = Preliminary Cleanup Standard

Ing_{NC} = Noncancer contribution from ingestion of chemicals in soil

$Derm_{NC}$ = Noncancer contribution from dermal contact with chemicals in soil

Inh_{NC} = Noncancer contribution from inhalation of chemicals in soil

Table B4.6
Preliminary Cleanup Standards (PCSs)
Contribution from Ingestion of Chemicals in SMA 4, Subsurface Soil, 2 -15 ft
Construction Worker
ERP Coke Facility, Birmingham, AL

Carcinogenic Effects

Equation	**Ing_C**	**=**	**(**	**TR**	**x**	**AT**	**x**	**BW**	**)**	**/**	**(**	**EF**	**x**	**ED**	**x**	**SF**	**x**	**IR**	**x**	**CF**	**)**
Units	**mg/Kg**			**unitless**		**years**		**Kg**				**days/yr**		**years**		**$(mg/Kg\text{-}day)^{-1}$**		**mg/day**		**Kg/mg**	
Benzo(a)pyrene	3.39E+00	=	(	1.E-06	x	25550	x	80	)	/	(	250	x	1	x	7.30E+00	x	330	x	1.00E-06	)
Benzene	4.50E+02	=	(	1.E-06	x	25550	x	80	)	/	(	250	x	1	x	5.50E-02	x	330	x	1.00E-06	)
Chlorobenzene	na	=	(	1.E-06	x	25550	x	80	)	/	(	250	x	1	x	nd	x	330	x	1.00E-06	)
Toluene	na	=	(	1.E-06	x	25550	x	80	)	/	(	250	x	1	x	nd	x	330	x	1.00E-06	)

Noncarcinogenic Effects

Equation	**Ing_{NC}**	**=**	**(**	**THQ**	**x**	**AT**	**x**	**BW**	**)**	**/**	**(**	**EF**	**x**	**ED**	**x**	**(**	**1**	**/**	**RfD**	**)**	**x**	**IR**	**x**	**CF**	**)**
Units	**mg/Kg**			**unitless**		**years**		**Kg**				**days/yr**		**years**					**mg/Kg-day**			**mg/day**		**Kg/mg**	
Benzo(a)pyrene	na	=	(	1.0	x	365	x	80	)	/	(	250	x	1	x	(	1	/	nd	)	x	330	x	1.00E-06	)
Benzene	1.42E+03	=	(	1.0	x	365	x	80	)	/	(	250	x	1	x	(	1	/	4.00E-03	)	x	330	x	1.00E-06	)
Chlorobenzene	7.08E+03	=	(	1.0	x	365	x	80	)	/	(	250	x	1	x	(	1	/	2.00E-02	)	x	330	x	1.00E-06	)
Toluene	2.83E+04	=	(	1.0	x	365	x	80	)	/	(	250	x	1	x	(	1	/	8.00E-02	)	x	330	x	1.00E-06	)

IngC = Carcinogenic contribution from ingestion of chemicals in soil
TR = Target Risk
THQ = Target Hazard Quotient
AT = Averaging time
BW = Body weight
EF = Exposure frequency
ED = Exposure duration
SF = Cancer Slope factor, oral
IR = Soil intake rate
CF = Conversion factor
RfD = Noncancer Reference dose, oral
nd = no data
na = not applicable

Table B4.7
Preliminary Cleanup Standards (PCSs)
Contribution from Dermal Contact with Chemicals in SMA 4, Subsurface Soil, 2 - 15 ft
Construction Worker
ERP Coke Facility, Birmingham, AL

Carcinogenic Effects

Equation	$Derm_C$	= (	TR	x	AT	x	BW	) / (	EF	x	ED	x	CSF	x	AF	x	SSA	x	EV	x	ABS_d	x	CF
Units	**mg/kg**		**unitless**		**days**		**Kg**		**days/year**		**years**		**$(mg/Kg\text{-}day)^{-1}$**		**mg/cm^2-event**		**cm^2**		**events/day**		**unitless**		**Kg/mg**
Benzo(a)pyrene	2.07E+01	= (	1.00E-06	x	25550	x	80	) / (	250	x	1	x	7.30E+00	x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Benzene	na	= (	1.00E-06	x	25550	x	80	) / (	250	x	1	x	5.50E-02	x	0.12	x	3470	x	1	x	nd	x	1.00E-06
Chlorobenzene	na	= (	1.00E-06	x	25550	x	80	) / (	250	x	1	x	nd	x	0.12	x	3470	x	1	x	nd	x	1.00E-06
Toluene	na	= (	1.00E-06	x	25550	x	80	) / (	250	x	1	x	nd	x	0.12	x	3470	x	1	x	nd	x	1.00E-06

Noncarcinogenic Effects

Equation	$Derm_{NC}$	= (	THQ	x	AT	x	BW	) / (	EF	x	ED	x	(1 /	RfD	) x	AF	x	SSA	x	EV	x	ABS_d	x	CF
Units	**mg/kg**		**unitless**		**days**		**Kg**		**days/year**		**years**			**$(mg/Kg\text{-}day)^{-1}$**		**mg/cm^2-event**		**cm^2**		**events/day**		**unitless**		**Kg/mg**
Benzo(a)pyrene	na	= (	1	x	365	x	80	) / (	250	x	1	x	(1 /	nd	) x	0.12	x	3470	x	1	x	0.13	x	1.00E-06
Benzene	na	= (	1	x	365	x	80	) / (	250	x	1	x	(1 /	4.00E-03	) x	0.12	x	3470	x	1	x	nd	x	1.00E-06
Chlorobenzene	na	= (	1	x	365	x	80	) / (	250	x	1	x	(1 /	2.00E-02	) x	0.12	x	3470	x	1	x	nd	x	1.00E-06
Toluene	na	= (	1	x	365	x	80	) / (	250	x	1	x	(1 /	8.00E-02	) x	0.12	x	3470	x	1	x	nd	x	1.00E-06

$Derm_C$ = Carcinogenic contribution from inhalation of chemicals in soil
TR = Target Risk
AT = Averaging time
BW = Body weight
EF = Exposure frequency
ED = Exposure duration
CSF = Cancer Slope Factor, dermal
AF = Skin/Soil Adherence Factor
SSA = Skin Surface Area
EV = Event frequency
ABS = Dermal Absorption Factor
CF = Conversion factor
$Derm_{NC}$ = Noncarcinogenic contribution from inhalation of chemicals in soil
THQ = Target Hazard Quotient
RfD = Noncancer Reference Dose, inhalation

Table B4.8
Preliminary Cleanup Standards (PCSs)
Contribution from Inhalation of Chemicals in SMA 4, Subsurface Soil, 2 - 15 ft
Construction Worker
ERP Coke Facility, Birmingham, AL

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Table B4.8 (cont.)
Preliminary Cleanup Standards (PCSs)
Contribution from Inhalation of Chemicals in SMA 4, Subsurface Soil, 2 -1 5 ft
Construction Worker
ERP Coke Facility, Birmingham, AL

Noncarcinogenic Effects

Equation	INH_{NC}	= (	THQ	x	AT	) / (	EF	x	ED	x	ET	x	CF	x (1 /	RfC	) x [(1 /	VF	) + (1 /	PEF	)]
Units	**mg/Kg**		**unitless**		**days**		**days/year**		**years**		**hours/day**		**days/hour**		**mg/m^3**		**m^3/Kg**		**m^3/Kg**	
Benzo(a)pyrene	na	= (	1.0	x	365	) / (	250	x	1	x	8	x	0.042	x (1 /	nd	) x [(1 /	2.89E+05	) + (1 /	5.70E+09	)]
Benzene	5.74E+02	= (	1.0	x	365	) / (	250	x	1	x	8	x	0.042	x (1 /	3.00E-02	) x [(1 /	4.41E+03	) + (1 /	5.70E+09	)]
Chlorobenzene	1.40E+03	= (	1.0	x	365	) / (	250	x	1	x	8	x	0.042	x (1 /	5.00E-02	) x [(1 /	6.46E+03	) + (1 /	5.70E+09	)]
Toluene	9.45E+04	= (	1.0	x	365	) / (	250	x	1	x	8	x	0.042	x (1 /	5.00E+00	) x [(1 /	4.35E+03	) + (1 /	5.70E+09	)]

Inh_C = Carcinogenic contribution from the inhalation of chemicals in soil
TR = Target Risk
AT = Averaging time
EF = Exposure frequency
ED = Exposure duration
ET = Exposure time
CF_1 = Conversion factor, day/hours
IUR = Inhalation Unit Risk
CF_2 = Conversion factor, g/mg
CSF = Cancer Slope Factor, inhalation
VF = Volatilization factor
PEF = Particulate emission factor
Inh_{NC} = Noncarcinogenic contribution from the dermal absorption of chemicals in soil
THQ = Target Hazard Quotient
RfC = Noncancer Reference concentration, inhalation

Table B4.9
Carcinogenic Preliminary Cleanup Standards (PCSs) for SMA 4, Subsurface Soil, 2 - 15 ft
Construction Worker
ERP Coke Facility, Birmingham, AL

Equation	PSC	= 1 / [(1 /	Ing_C	) + (1 /	$Derm_C$	) + (1 /	Inh_C	)]
Units	**mg/kg**							
Benzo(a)pyrene	2.81E+00	= 1 / [(1 /	3.39E+00	) + (1 /	2.07E+01	) + (1 /	7.99E+01	)]
Benzene	1.24E+02	= 1 / [(1 /	4.50E+02	) + (1 /	na	) + (1 /	1.72E+02	)]
Chlorobenzene	na	= 1 / [(1 /	na	) + (1 /	na	) + (1 /	na	)]
Toluene	na	= 1 / [(1 /	na	) + (1 /	na	) + (1 /	na	)]

PSC = Preliminary Cleanup Standard

Ing_C = Noncancer contribution from ingestion of chemicals in soil

$Derm_C$ = Noncancer contribution from dermal contact with chemicals in soil

Inh_C = Noncancer contribution from inhalation of chemicals in soil

Table B4.10
Noncarcinogenic Preliminary Cleanup Standards (PCSs) for SMA 4, Subsurface Soil, 2 - 15 ft ft
Construction Worker
ERP Coke Facility, Birmingham, AL

Equation	**PSC**	**= 1 / [(1 /**	**Ing_{NC}**	**) + (1 /**	**$Derm_{NC}$**	**) + (1 /**	**Inh_{NC}**	**)]**
Units	**mg/kg**							
Benzo(a)pyrene	na	= 1 / [(1 /	na	) + (1 /	na	) + (1 /	na	)]
Benzene	4.09E+02	= 1 / [(1 /	1.42E+03	) + (1 /	na	) + (1 /	5.74E+02	)]
Chlorobenzene	1.17E+03	= 1 / [(1 /	7.08E+03	) + (1 /	na	) + (1 /	1.40E+03	)]
Toluene	2.18E+04	= 1 / [(1 /	2.83E+04	) + (1 /	na	) + (1 /	9.45E+04	)]

PSC = Preliminary Cleanup Standard

Ing_{NC} = Noncancer contribution from ingestion of chemicals in soil

$Derm_{NC}$ = Noncancer contribution from dermal contact with chemicals in soil

Inh_{NC} = Noncancer contribution from inhalation of chemicals in soil